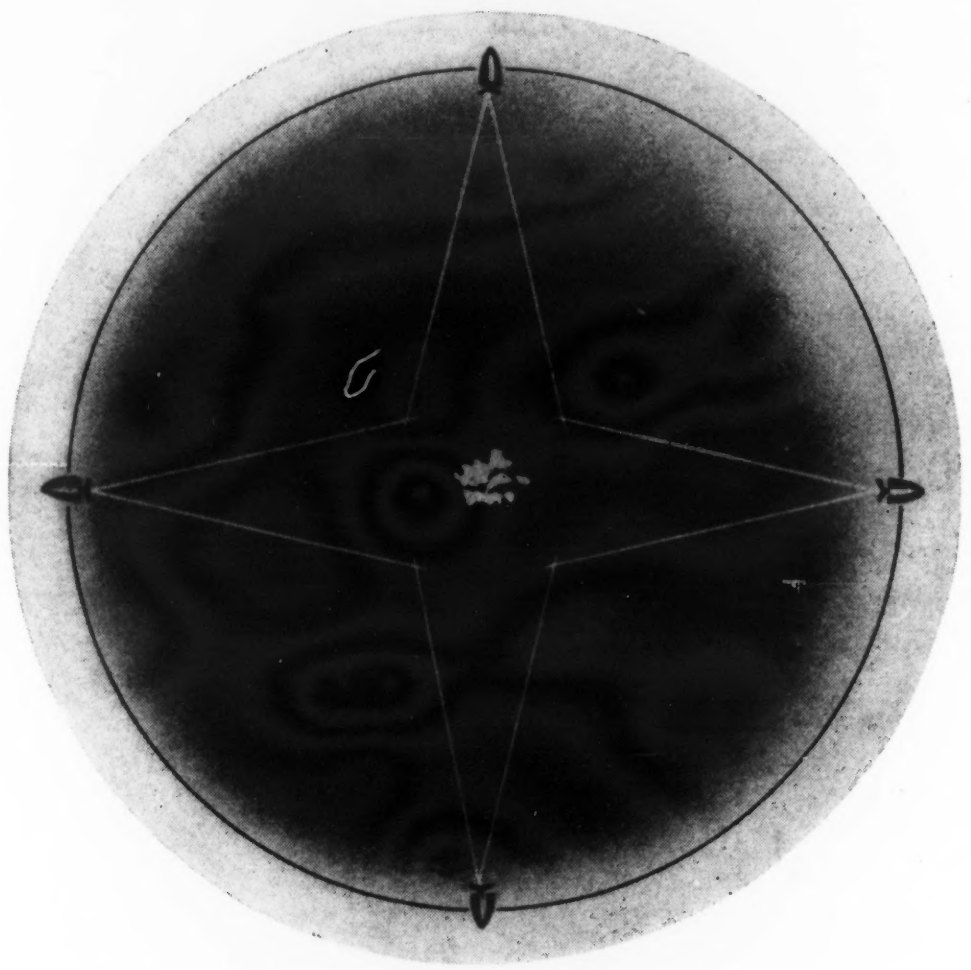
SIGNAL

January 1959

Communications—Electronics—Photography • On Land Sea and Air



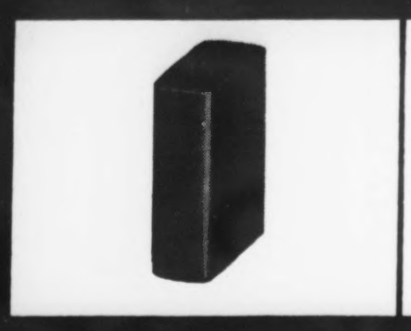
Active Space Relay Station

"This is the President of the United States speaking. Through the marvels of scientific advance, my voice is coming to you from a satellite circling in outer space.

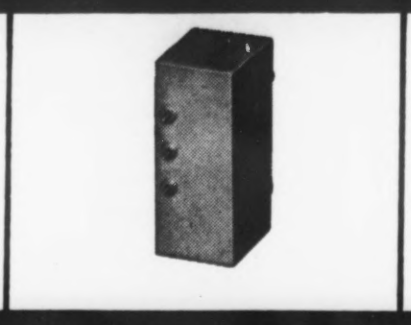
"My message is a simple one. Through this unique means, I convey to you and to all mankind America's wish for peace on earth and good will toward men everywhere."

President Eisenhower's Message From The Earth Satellite Atlas

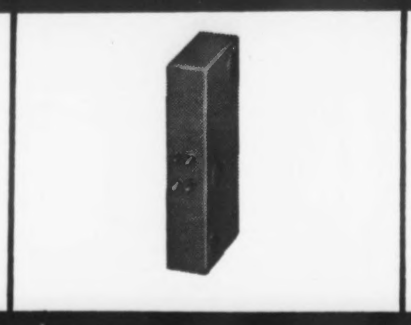
FILTERS
All types for frequencies from .1 cycle to 400 MC.



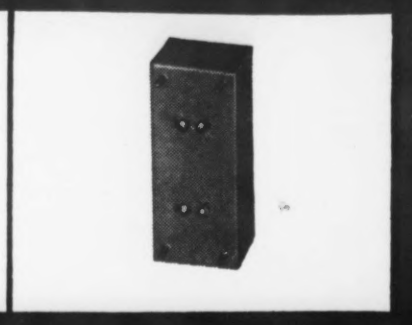
400 ⎓ telemetering, 3 db at ⎓ 7.5%, 40 db at 230 and 700 ⎓. ⅝ x 1¼ x 2".



15 ⎓ BP filter, 20 db at 30 ⎓, 45 db at 100 ⎓, phase angle at CF less than 3° from —40 to + 100° C.

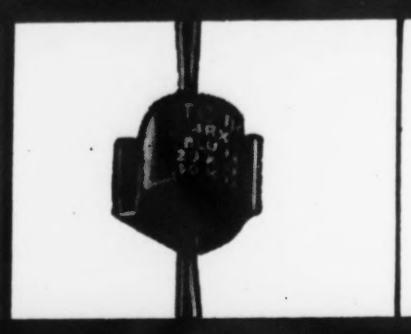


LP filter within 1 db to 49 KC, stable to .1 db from 0 to 85° C., 45 db at 55 KC.

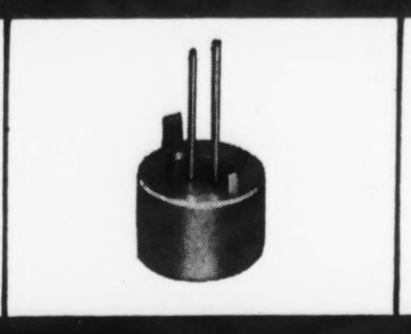


LP filter less than .1 db 0 to 2.5 KC, 50 db beyond 3 KC.

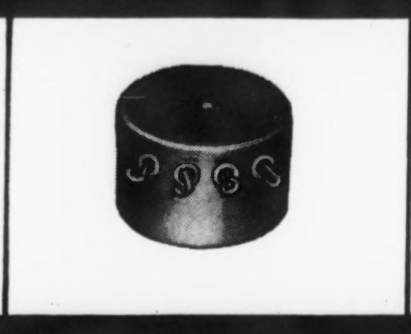
HIGH Q COILS
Toroid, laminated, and cup structures from .1 cycle to 400 MC.



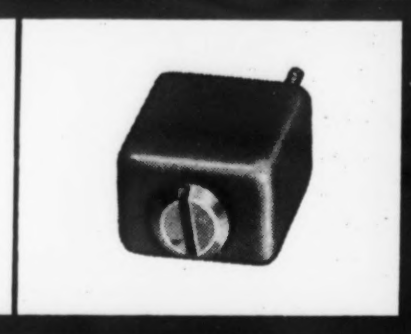
Tuned DO-T servo amplifier transformer, 400 ⎓ .5% distortion.



Toroid for printed circuit, Q of 90 at 15 KC.

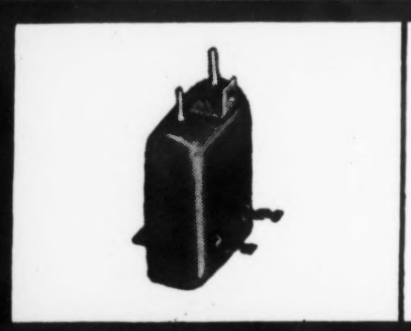


Dual toroid, Q of 75 at 10 KC, and Q of 120 at 5 KC.

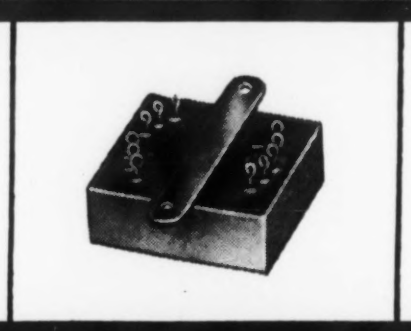


HVC tapped variable inductor for 3 KC oscillator.

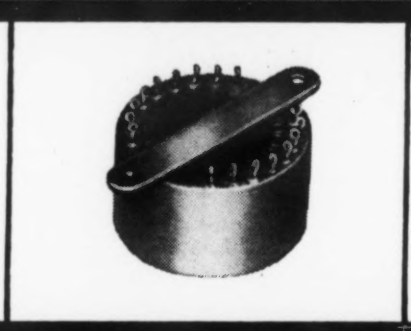
SPECIALTIES
Saturable reactors, reference transformers, magnetic amplifiers, combined units.



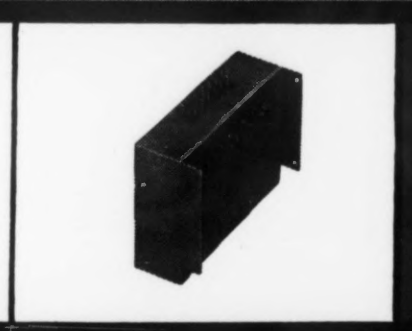
RF saturable inductor for sweep from 17 MC to 21 MC.



Voltage reference transformer .05% accuracy.

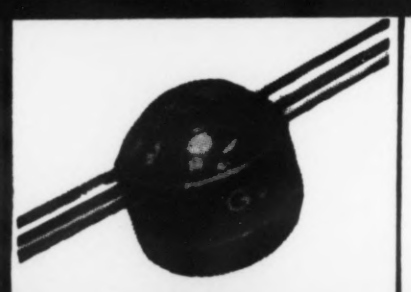


Multi-control magnetic amplifier for airborne servo.



Input, output, two tuned interstages, peaking network, and BP filter, all in one case.

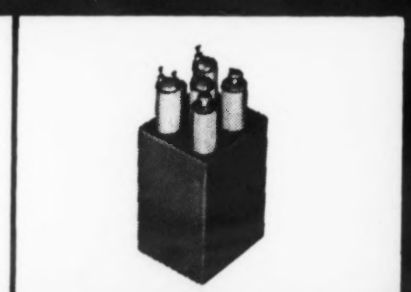
PULSE TRANSFORMERS
From miniature blocking oscillator to 10 megawatt.



Wound core unit .01 microsecond rise time.

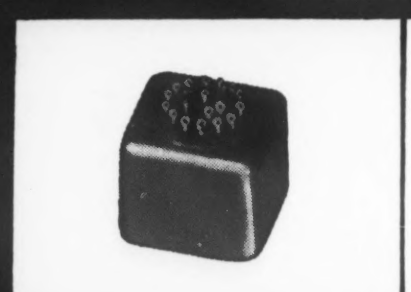
Pulse current transformer 100 Amp.

Pulse output to magnatron, bifilar filament.

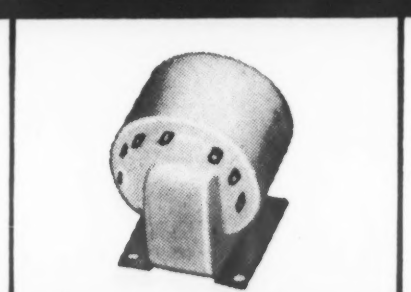


Precise wave shape pulse output, 2500 V. 3 Amps.

POWER COMPONENTS
Standard and high temperature . . . hermetic, molded, and encapsulated.

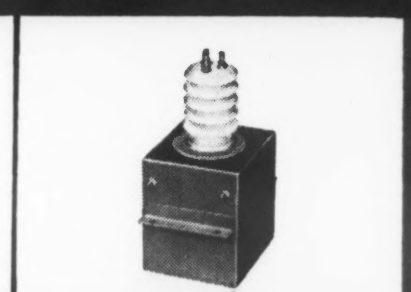


Multi-winding 140 VA, 6 KC power transformer 1¼ x 1¼ x 1"



200° C. power transformer, 400 ⎓, 150 VA.

400 ⎓ scope transformer, 20 KV output.

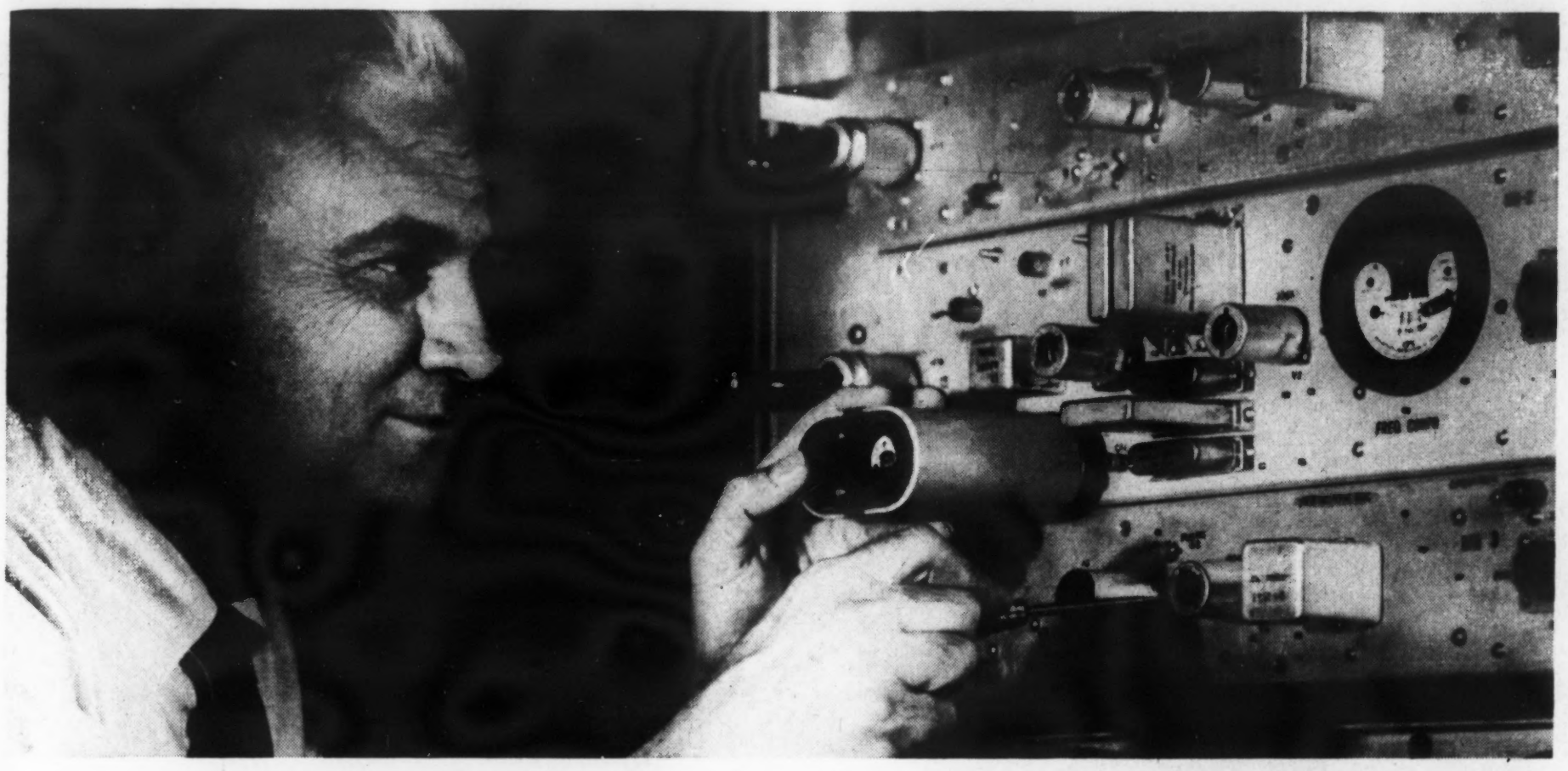


60 ⎓ current limiting filament transformer, Sec. 25 Mmfd., 30 KV hipot.

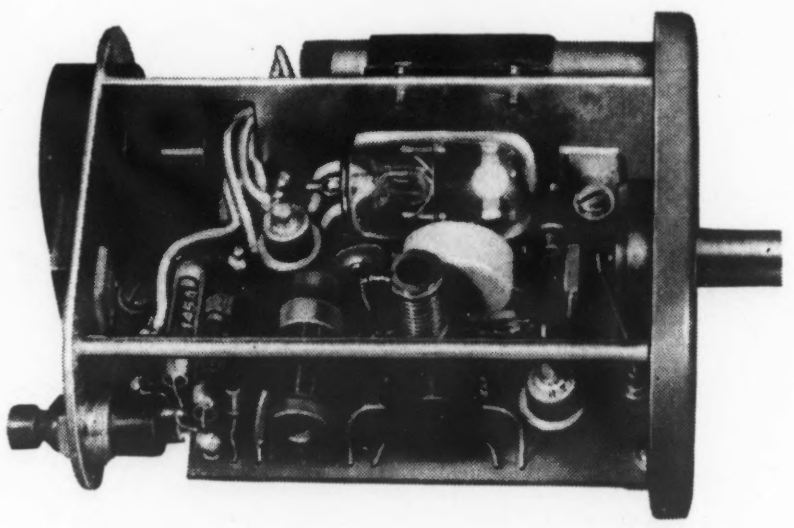
UNITED TRANSFORMER CORPORATION

150 Varick Street, New York 13, N. Y. • EXPORT DIVISION: 13 E. 40th St., New York 16, N. Y.,
CABLES: "ARLAB" PACIFIC MFG. DIVISION, 4008 W. Jefferson Blvd., Los Angeles, Cal.

Bell Laboratories Develops Pocket-Sized Frequency Standard for Microwave Systems



Lawrence Koerner, who developed the portable frequency standard, demonstrates how the device can be plugged in at a radio relay station to supply a checking frequency. Battery-powered, the device maintains precision calibration for several months.



Inside the portable frequency standard. Four Laboratories-developed devices make it possible: (1) transistor, which converts the power from a battery to radio frequency oscillations; (2) voltage reference diode, which maintains constant voltage; (3) piezoelectric crystal unit of superlative stability; (4) thermistor, which corrects for temperature variations.

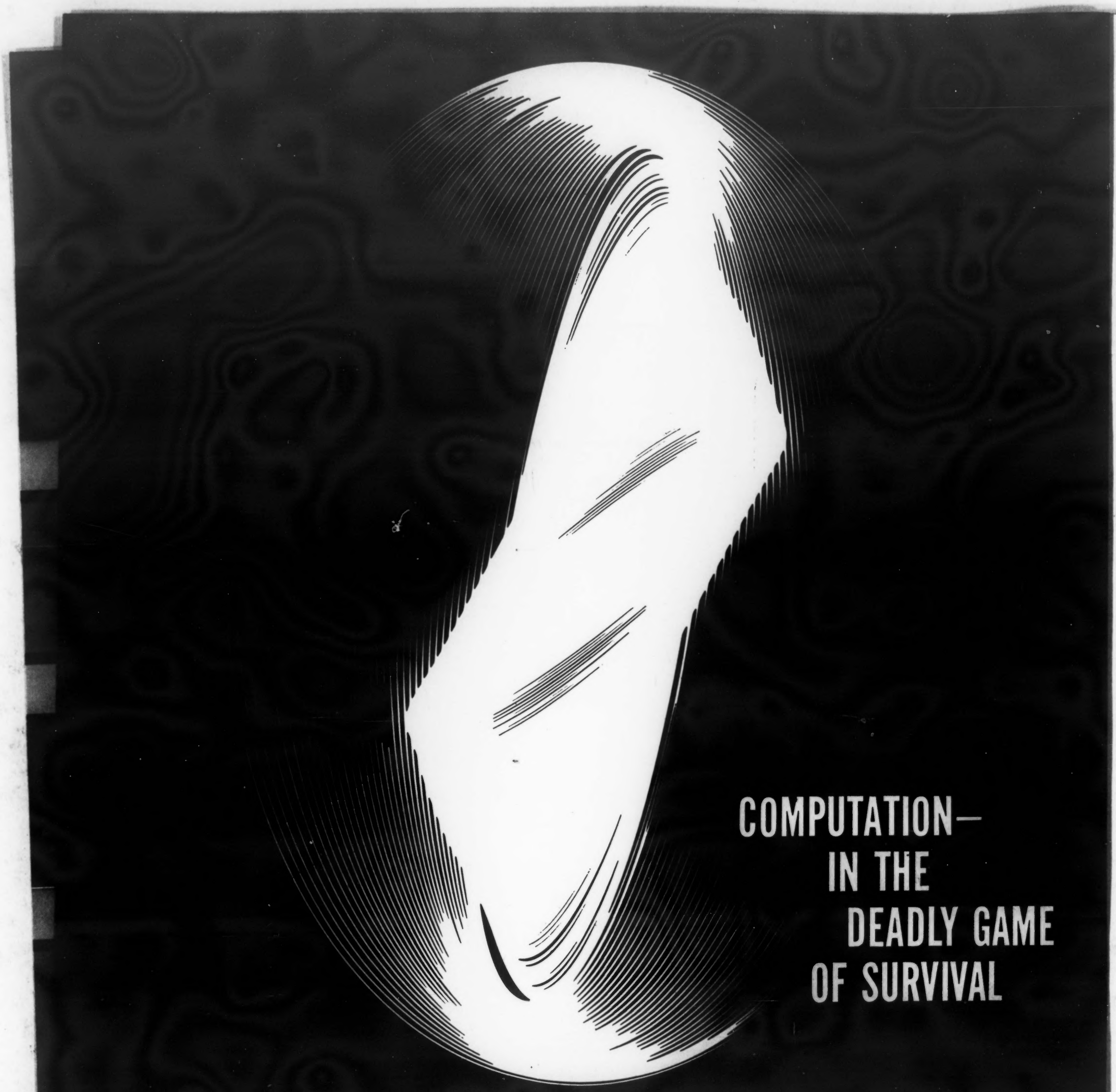
Microwave radio relay systems depend critically on the accuracy of their "carrier" frequencies. At scores of relay stations along a route, carrier frequency oscillators must be checked periodically against a signal from a precise standard.

In the past, the maintenance man has had to obtain his checking frequency by picking up a standard radio signal from a government station. This operation takes time — and requires elaborate equipment.

With a new *portable* frequency standard developed by Bell Telephone Laboratories engineers, the job is much simplified. To check an oscillator, the portable standard is plugged in, and a button is pressed. In seconds, it supplies a checking frequency accurate to one part in a million.

Until now, such precision in a frequency standard has been obtainable only in a laboratory. The new portable standard makes it available for routine use in the Bell System. First use of the standard will be to maintain frequency control in a new microwave system for telephone and TV, now under development at Bell Laboratories. Other potential uses include on-the-spot maintenance of closely spaced channels of commercial and military communication systems.

BELL TELEPHONE SYSTEM



COMPUTATION— IN THE DEADLY GAME OF SURVIVAL

BURROUGHS SYSTEMS STUDIES PLAY A VITAL ROLE IN DEFENSE

Problem: How to puncture-proof our air defense against enemy bomber and missile threats. Solution: Systems Studies of all operational problems—studies whose very heartbeat is electronic computation. Burroughs is acknowledged a master in all phases of such computation and its related areas, through its priceless combination of technical competence, outstanding experience and the most advanced research facilities.

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BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XIII JANUARY 1959 NUMBER 5

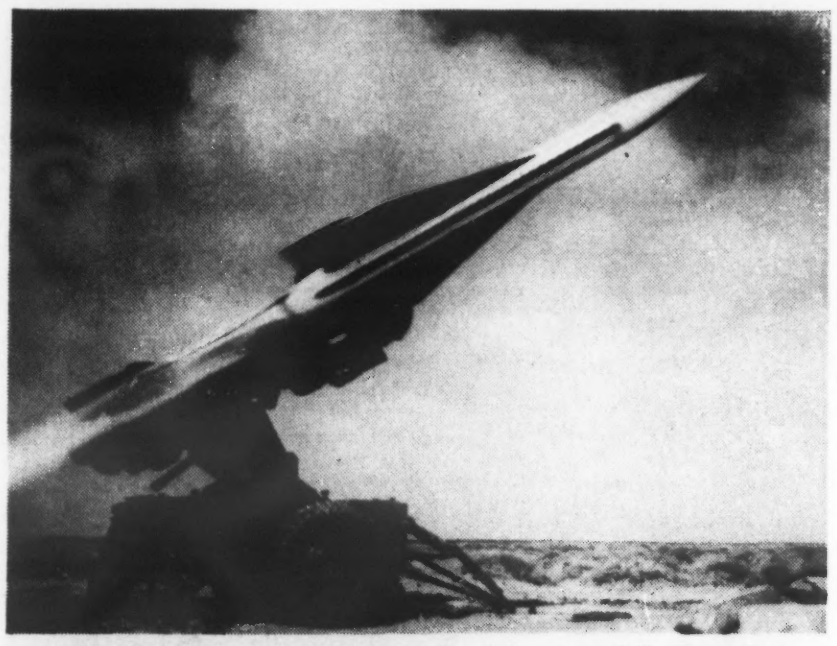
CONTENTS

Cover

The cover photo is an artist's conception of an active space relay system comprising four earth synchronous communications satellites working in conjunction with four ground stations. By multiple ground-satellite-ground relay, communications between each of the four stations can be accomplished. Major E. N. Wright, USAF, Chief Communications observer, Electronics Directorate, ARDC, Andrews Air Base, will report more fully on this in a subsequent issue of SIGNAL.

Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.

RAYTHEON-DESIGNED Hawk missile annihilates radio-controlled F-80 jet fighter at 500 ft. altitude.



ARMY'S HAWK MISSILE is fired from mobile launcher. Missiles, launcher and support equipment can be air-lifted or quickly transported by Army or Marine ground forces.

NEW ARMY MISSILE DESTROYS LOW-FLYING AIRCRAFT

This *proven* anti-aircraft missile operates even at tree-top heights, in the blind zone of other radar-controlled missiles.

Raytheon is prime contractor for the U.S. Army Hawk weapon system—now in production and slated for use with fast-moving Army and Marine Corps ground forces as well as for the defense of U. S. cities.

RAYTHEON

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RAYTHEON MANUFACTURING COMPANY, Waltham, Mass.

PRESIDENT FREDERICK R. FURTH

Rear Admiral, USN (Ret.)
Vice President, ITT Corp.
NATIONAL PRESIDENT, AFCEA

The advancement of electronics since World War II has focused the nation's attention on an industry literally bursting at the seams and one whose future is as exciting as the exploration of space. We can be justly proud in the knowledge that AFCEA has kept pace with the times. We have maintained a steady course, even during a recessional period, while riding the crest of this advancing wave.

For the past twelve years SIGNAL Magazine, the official journal of the Armed Forces Communications and Electronics Association, has been keeping our group and individual members authentically informed on all important phases of communications, electronics and photography. This past year, National Headquarters, the Board of Directors, Executive Committee, Officers and members of the Association, plus our Chapters, Advertisers, Authors and all those connected with the publication of SIGNAL have made significant contributions to our Association's progress.

As we hoist our sails for the twelve months journey which lies ahead, I am sure that the interest which everyone has shown to advance the ideals and objectives of AFCEA will be carried on throughout 1959.

I wish to take this opportunity to express my sincere thanks and appreciation for the continuing support which I have received and extend to everyone my personal greetings and profound wishes that the New Year may bring you good health and the fulfillment of your most cherished hopes.

instrumentation

the measuring rod of technology

by Henry B. du Pont
Vice President and
Director of
E. I. du Pont de Nemours
and Company

IT has been many years since I was engaged in scientific and engineering problems involving instrumentation. Over the ensuing years, developments in this field have been of such magnitude that to compare the instrumentation techniques of 25 years ago with those of today would be like trying to compare a World War I airplane with today's guided missile. I must, therefore, leave discussion of the scientific aspects of instrumentation to the experts of today and I will confine my remarks to the broad business and national aspects of the great developments in this field.

The exciting prospects for the future in this field are similar to those which must have been experienced by visitors to the great Philadelphia exhibition which took place 82 years ago. Through the summer of 1876, Philadelphia offered to several million visitors a notable exhibit of the mechanical arts which was to have far-reaching significance upon American technology. The Centennial Fair, with the theme of "Power," indicated to all the world the fact that America was on its way to its destiny as the greatest industrial nation on earth, and to a whole generation of youngsters it kindled the flames of imagination and ambition.

The Philadelphia Centennial symbolized to the nation that the simple agrarian economy of the first hundred years was over. It had become plain that the future lay in development of machinery which could multiply the effort of each man a hundredfold. The mechanical revolution which the great exhibition signified was well on its way, and within the next few years it achieved a miracle of production which astonished everyone. For instance, in the year the Civil War ended, industrial output in the United States was two-thirds that of Britain; by 1900, it was twice as great.

In the first years of the new American continent, although land itself was plentiful, when 10 men sat down at dinner, the food on the table represented the full-time effort of most of them. It is unlikely that this ratio had changed greatly from that which prevailed a hundred years earlier, or indeed, which had been the lot of man since Biblical times.

By 1900, production of farm goods and other consumer products was 150 per cent over that of 1850, and within 10 years would rise another 50 per cent. On the farm, the reaper, the steel plow, and the steam harvester has supplanted the peasant methods of former centuries. The age of machinery has been born, and, under our free institutions, it has flourished. America in a few decades witnessed the transformation of a wilderness into a rich, productive and dynamic nation. Each year saw new advances in industrial output and the rate of growth continued to multiply at an average increment of two to three per cent a year. American genius for mechanical contrivances and technical innovation had, by 1900, made industry the nation's major activity, with agriculture's demands for manpower constantly decreasing.

Machinery was the instrument which can be said to have characterized the first great stage of American industrial development. Today, we are on the doorstep of another era, an era of equal significance. If the latter half of the nineteenth century were the age of machines, the latter half of the twentieth century may well be designated by the historians as the age of *instrumentation*, or, to describe it more exactly, as *the age in which we developed machines to operate machines* and operate them more skillfully and more efficiently.

There is as yet little popular understanding of what is meant by instrumentation and what it has contributed to industrial development. It may be that, at some point, it will be necessary to create a new term which will describe the function with greater clarity. As an example of the need for exactness, it is a fact that an employee of a Congressional committee looking into technological advancements recently made the happy assumption that the instrument industry was concerned with the manufacture of snare drums and gold trombones!

Perhaps the whole field would be understood somewhat better if the average person understood how essential the instrumentation process is, even in daily life. Modern instrumentation is well demonstrated in such a familiar device as the automatic washing machine. Instruments assess temperatures, pressures, speed and weight and, as each measurement is taken, translate the data into a control mechanism so that the cycle proceeds in automatic sequence. Much the same thing happens in the dish washer, in the thermostatically controlled heating system, in the air-conditioning unit and refrigerator.

Instrumentation is actually the outgrowth of the blending of science and industry. Instruments are essentially devices used for measurement, and measurement of physical phenomena in terms of quantitative record is the essence of science itself. Measurement, in a way, is a universal language, one through which men of many tongues find a common method of communication. And it is a language in which much of the world's history has been written.

The measuring rod represents one of the most basic and fundamental of human achievements. In their most primitive forms, standards of measure began with the simple units which might have measured the dimensions of the human body or the height of a horse. It is probable that such needs suggested the width of the hand, the terminal joint of the thumb and the foot from toe to heel as accepted units. It might be said that civilization really began when common units of measure came to be generally adopted. Our earliest form of construction obviously required standards of linear measure and weights.

From simple beginnings, early scientists extended their range of interest and curiosity to measure heat, pressure, and the density of air. They developed new yardsticks with which to measure their findings, and, over the centuries, new words came into the language as the fields under observation broadened. When studies of

the phenomena of electricity began, new words like volt, ampere, and ohm were coined from the names of scientists concerned.

So units of measure and the use which men have learned to make of them are at the very root of scientific inquiry. But, today, we have learned to extend our investigations into strange new worlds which would have startled and amazed the early seekers after knowledge. Today, for example, we have the means of measuring such delicate matter as the metabolism of the human system, the electrical waves traveling through the brain, and the tiny electrical impulses which precede each heartbeat.

Instruments can now identify and classify the free radicals whose life span is reckoned in fractions of one-millionth of a second, greatly extending the bounds of physical chemistry. To control the various properties of materials like nylon, polyethylene, and neoprene, we now have the means of charting the spacing of their molecules.

We have achieved through modern scientific instruments whole new standards of precision and sensitivity. We can now gauge vacuums so complete that they are computed to one-trillionth of the pressure of the normal atmosphere. There are instruments so sensitive that they will detect a leak so minute that it would require 25 years for a single cubic centimeter of air to escape from a vessel. If you are calculating this in terms of how long it would take a tire to go flat, I can tell you that, at the same rate, a standard tire casing would still be reasonably firm after 900,000 years. But let's not be too impressed with our modern precision, because history records that the early Aztecs, in perfecting a calendar based on the rotation of the earth, had a margin of error which totaled one day in 175,000 years, and that 2,000 years before Columbus, the circumference of the earth had been calculated to within one per cent of absolute correctness.

Early scientific instruments were largely devoted to telling man what he needed to know, leaving any further action to human hands. Instrumentation, as we understand it today, carries us many steps further. It takes its place as an integral part of industrial processing, actuating control mechanisms, without further human intervention. This permits us today to use highly complex production processes and to control them largely through automatic devices.

Although automatic control, made possible by modern instrumentation, saves labor, it is not primarily just a labor-saving device. Without it, many of our more intricate industrial processes could not operate at all, at least not efficiently enough to maintain quality even at higher cost. Manufacture today in many industries requires such precise and intricate controls at so many points in the process that it would be literally impossible to operate through human manipulation.

To a degree which is little realized, the manufacture of everything from a suit of clothes to a guided missile involves continual measurement and the continual translation of the results into specific actions.

On the most elementary level, the necessary measurement can be as simple as the use of the tape measure in cutting yard goods into proper lengths. But even in the manufacture of so staple an article as a suit of clothes, modern standards require literally thousands of measurements to be taken, involving the thickness of the yarn from which the cloth is woven, the speed of the machine which spun it into usable form, the temperature, viscosity, composition and rate of flow in the sizing agents and scores of other readings, ranging from the refraction index of the dye colors, to the speed, velocity, temperature, and humidity of the production process calculated to give the greatest output consistent with quality and cost. And all this goes on long before there is any consideration whatever of whether the trousers are a bit too long!

Instrumentation finds its most significant role as a vital and creative component of our modern technology, and it is here that it shows the greatest promise for the future.

Innovation in the field of automatic production processes has already developed a number of wholly new principles. In the chemical field, it has reached such a point that the more modern plants are in themselves instruments whose function is wholly continuous and fully automatic. In one of the newer processes recently installed, instruments make no less than 7,000 check readings continually as the product flows through the complex equipment.

Instrumentation, as we know it today, represents no new monster to be feared from the social viewpoint. It is a logical and evolutionary extension of our technology, a force which brings together machinery and equipment, skills and techniques, men, money, and methods. It signifies not job displacement, but job opportunity. For example, in the chemical industry the installation of automatic processes has been accompanied by a steady rise in employment. There is little evidence in this that the machine is menacing man.

We have met our production needs only by placing at the disposal of the worker complex and intricate equipment. Behind it is the concentrated effort of a large group of technically sophisticated specialists facing new horizons which, each year, have challenged the new and the untried. Through our advancing technology, the capacity of each of us to produce in the measure of pints, ounces, and dozens has been expanded so enormously that it is reckoned in bushels, in pounds, and in gross, or even in carloads, in tons, and in thousands.

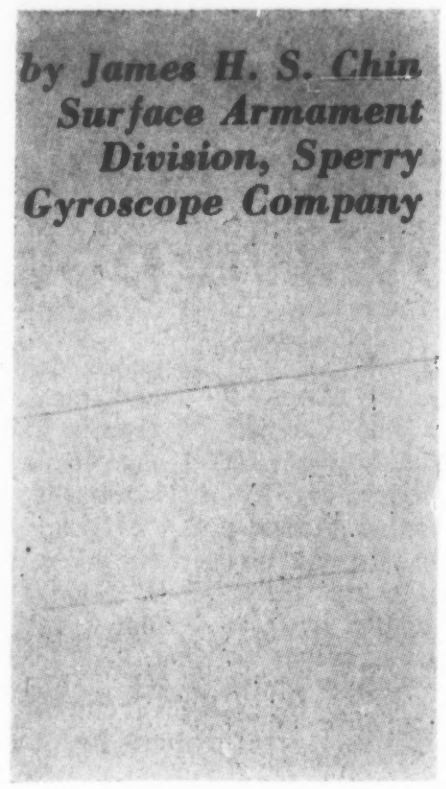
The major significance of the entire instrumentation development, however, is not scientific or economic, but social. Its successful expansion will in very large part determine what kind of a world we will live in 20 years hence—whether we advance in accordance with our dreams, or retrogress through our incapacity to meet demands.

The kind of society we have is closely linked to our capacity to produce. In the middle of the past century when production was low, the average American youngster attended school for less than six years. Even this modest requirement was regarded in some circles as an affectation. Jefferson, half a century before, had thought three years of schooling to be adequate.

At the other end of life, the question of retirement was, for the average person, a remote dreamland reserved for merchant princes, though most Americans, the merchant prince and his clerks alike, stayed in harness until they were no longer able to perform their duties—and many of them, I am afraid, long afterward. The average worker in the last century, for example, assuming that he lived out the proverbial three score and ten, worked for 56 years, laboring 70 hours a week, 52 weeks, a year, or a total of some 200,000 hours. Today's average worker spends some 46 years on the job and with shorter hours, vacations, and early retirement, his working life adds up to 90,000 hours, or less than half the time put in a century ago.

Today, our aspirations for ourselves and our children have led us to a far different way of life. We have elected to dedicate a part of the gains received from advancing technology to shortening the period at each end

(*Continued on page* 13)



Optimum Design for Reliability — the Group Redundancy Approach

by James H. S. Chin
Surface Armament Division, Sperry Gyroscope Company

AFTER WORLD WAR II, the growing concern over the unreliability of military electronic equipment led to the formation of the Ad Hoc Group and later the Advisory Group on Reliability of Electronic Equipment in the Research and Development Board, Department of Defense. To quote from a report of the former group: "It is imperative that electronic equipment be reliable, but it is not. For example, a study made in 1950 showed that only 33% of Navy electronic equipment was operating satisfactorily and later reports indicated that the situation was worse . . ."

In recent years the electronic equipment has tended rapidly toward increased size and complexity. As the state of the art advances, performance requirements of electronic equipment become more numerous and more difficult to meet. Consequently, equipment complexity is unavoidable. Furthermore, an equipment is often required to operate in conjunction with other electronic equipments to form a weapon system. This emphasizes the need for equipment reliability. Like a chain, a weapon system is only as strong as its weakest link. Any compromise in equipment reliability directly jeopardizes the successful operation of the system.

The term "reliability" is often used rather nebulously. For example, some consider reliability to be the ratio of system "ON" time to "ON" plus "DOWN" time; others relate it to the number of failures occurring in a given period of time; still others consider reliability to be a function of the maintenance time required to obtain a given number of hours of operation.

With these various interpretations of reliability, there is an obvious need for a comprehensive definition which encompasses directly or indirectly all of the definitions above. The generally accepted one in use today is the Electronic Industries Association (formerly R.E.T.M.A.) definition which reads as follows: "Reliability is the probability of a device performing its purpose adequately for the period of time intended under the operating conditions encountered."

Successful performance when needed, then, is a measure of system or equipment reliability.

Reliability Objective

The reliability requirements of a piece of equipment depend largely on 3 factors: (1) complexity of the equipment, (2) type of service for which the equipment is intended and (3) the time during which the equipment is expected to operate. For example, a modern tracking radar, which is a complex equipment, is used in fire control service. The actual tracking of the target may last only a few minutes. The reliability or probability of successful performance during these few minutes must be very high, say 0.99, or the safety of the defended area will be jeopardized. As another example, a home radio receiver is a relatively simple electronic equipment. A satisfactory reliability for this radio over a 2-year period of intermittent operation may be only 0.5.

For purposes of illustration, a typical system having 500 vacuum tubes (used as a part of a weapon system) was analyzed. The period during which it was required to operate was one hour.

Determination of optimum system reliability depends on 2 factors: (1) the degree or level of reliability desired for a given period of operation must be specified and (2) the amount of engineering effort required to achieve the specified reliability must be minimized.

In the example, let the desired system reliability for one hour of operation be 0.999. This is a great increase in reliability over a conventional system (i.e., non-redundant system) which in general has a reliability of only 0.9 for the same period of operation. To say it another way, the probability of failure of a conventional system is 0.1 and the probability of failure of the new system is 0.001. Thus for an operation period of one hour, the probability of failure of the new system is one hundred times less than that of a conventional system. This improvement in reliability certainly seems attractive. The problem is, then, can it be done at a reasonable cost of engineering effort? A thorough analysis of this question was made and it can be stated that such an improvement can be had through the application of group redundancy techniques and with very little increase in over-all engineering effort.*

Conventional Methods of Approach

There are many conventional methods which can be employed to enhance equipment reliability. The most promising ones are: (1) vacuum tube improvement (2) transistorization and (3) single element redundancy.

• *Vacuum tube and component improvements:* From the standpoint of vacuum tube and component improvements, an increase of T/KN (the mean time-to-fail of the system) by a factor of 2 is substantial. Engineering effort required to achieve such an improvement is undoubtedly very great. However, from the standpoint of system reliability, a Q (reliability improvement factor) of 2 represents very little improvement. Hence, an all-out vacuum tube and component improvement program yields, at best, a slight improvement in system reliability with a great increase in engineering effort.

An analysis has proven that the desired system reliability improvement, a Q of 100 for an operating period of one hour, cannot be met by a vacuum tube and component improvement approach, even at a high cost of engineering effort.

• *Transistorization:* The trend toward transistorization in equipment design has been growing at a rapid pace. There have been claims of expected transistor life as high as one million hours. This certainly is a great improvement over the vacuum tube. However, the reliability of vacuum tubes or transistors is only one of many factors that contribute to the reliability of an electronic

*This analysis is available by writing to the author or to SIGNAL Magazine.

equipment. For example, various investigations have indicated that, typically, vacuum tubes represent 15% of part population and account for 67% of all failures reported. This is to say that other component failures such as resistors, capacitors, relays, transformers, mechanical components, etc., represent 33% of all failures reported. One can say, though somewhat inaccurately, that even if vacuum tubes or transistors were 100% reliable, the failure rate would be reduced by a factor of three. Since there are no tubes or transistors which are 100% reliable, a more realistic examination of the problem becomes necessary.

It is worthwhile to compare the probability of failure of a conventional vacuum tube system with a fully transistorized one. The problem is idealized by the following assumptions: (1) Transistors are exact equivalents of vacuum tubes. (2) The mean time-to-fail of transistors is the same as the mean time-to-fail of all components other than vacuum tubes (80,000 hours).

With these assumptions, a new set of system constants can be arrived at, based on the constants given to a vacuum tube system (remembering that tubes represent 15% of total part population in a vacuum tube system and that they contribute 67% of all systems failures). An analysis based on the above constants proved that a 100% transistorization program, though it enhances system reliability, does not meet the desired system reliability improvement of 100.

• *Single element redundancy:* Redundancy is the use of parallel (or series) components to reduce the probability of failure. A familiar example is the double headlights on an automobile. The objective is, of course, to minimize the chance of driving in the dark. Similarly, redundancy can be introduced into electronic equipment. It may seem surprising that an increase in the number of electronic components can decrease the probability of system failure, but redundancy does just that. For example, assume that the probability of failure of a component in a given time is 0.001. If this component is made redundant by operating two components in parallel, the probability of failure of both components is $(0.001)^2$ or 0.000001. Thus, by using twice as many components, the probability of failure has been reduced 1,000 times. This is expressed as an improvement factor Q of 1,000.

A 100% single element redundancy does offer a great increase in Q, but the engineering effort required to accomplish this end is prohibitively great. On the other hand, a partially single element redundancy system (perhaps as much as 30%) may require an insignificant amount of extra engineering effort, but the reliability improvement is also insignificant. (See Fig. 1.)

Repair and maintenance are other factors which must be considered in optimizing the reliability of the system. There is always a possibility that a circuit or circuits will fail during a given period of operation. Unless these can be located and replaced quickly, the reliability of the system is greatly reduced. This points to the fact that for every redundant element (i.e., single element redundancy), there must be some means provided to detect a failure as it occurs. Thus, equipment complexity is greatly increased, and the engineering effort necessary to accomplish this end is also correspondingly increased. Furthermore, there are portions of the system which do not lend themselves readily to single element redundancy.

Group redundancy consists of two sets of circuits which form a redundant group. Figure 2 represents such a system. It has the advantage of high reliability improvement factor at a relatively small increase in over-all engineering effort.

Like the single element redundant system, each redundant group must be provided with a failure detector. However, the number of failure detectors in the system is determined by the number of redundant groups. An analysis demonstrated that a system with an n (the number of elements in a group) of 40 would require 12 failure detectors (or detector-switch combinations). If single element redundancy were used, this same system would require 500 failure detectors. Furthermore, it is far simpler to design a group redundant unit than a single-element redundant unit. For example, it takes very little more engineering effort to design two identical power supplies (and operate them as a redundant group through a failure detector and a switch) than to design one power supply. On the other hand, it is extremely difficult to design a single power supply with redundancy in each element or stage and to operate each stage through a failure detector and a switch.

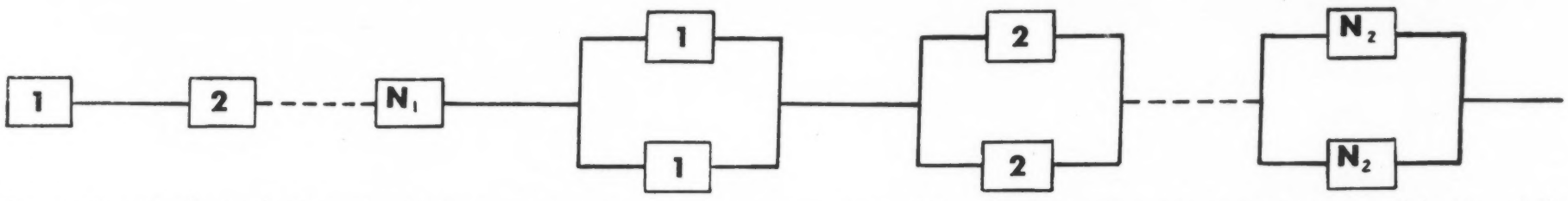
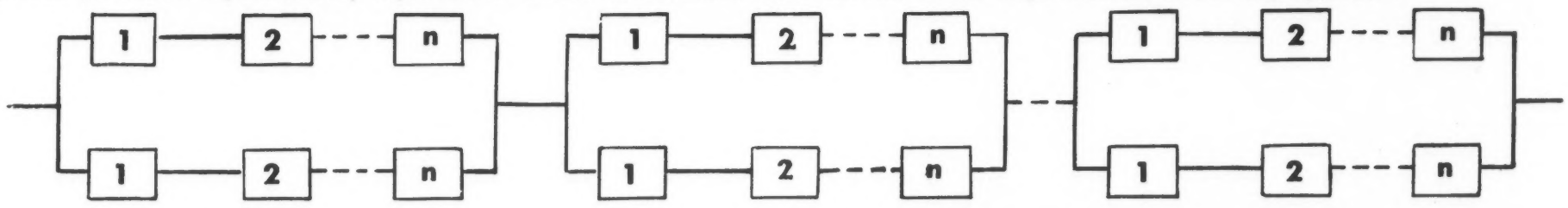


Fig. 1—A partially single-element redundant system such as the one shown above utilizes duplicate elements operating in parallel. Use of this method limits improvement in reliability, since failure of any non-redundant element can bring about immediate system failure.

Fig. 2—A group redundant system combines single elements in logical units (groups) which are operated in parallel, as shown below. This approach provides a high reliability improvement without the excessive effort involved in the single element redundancy approach.

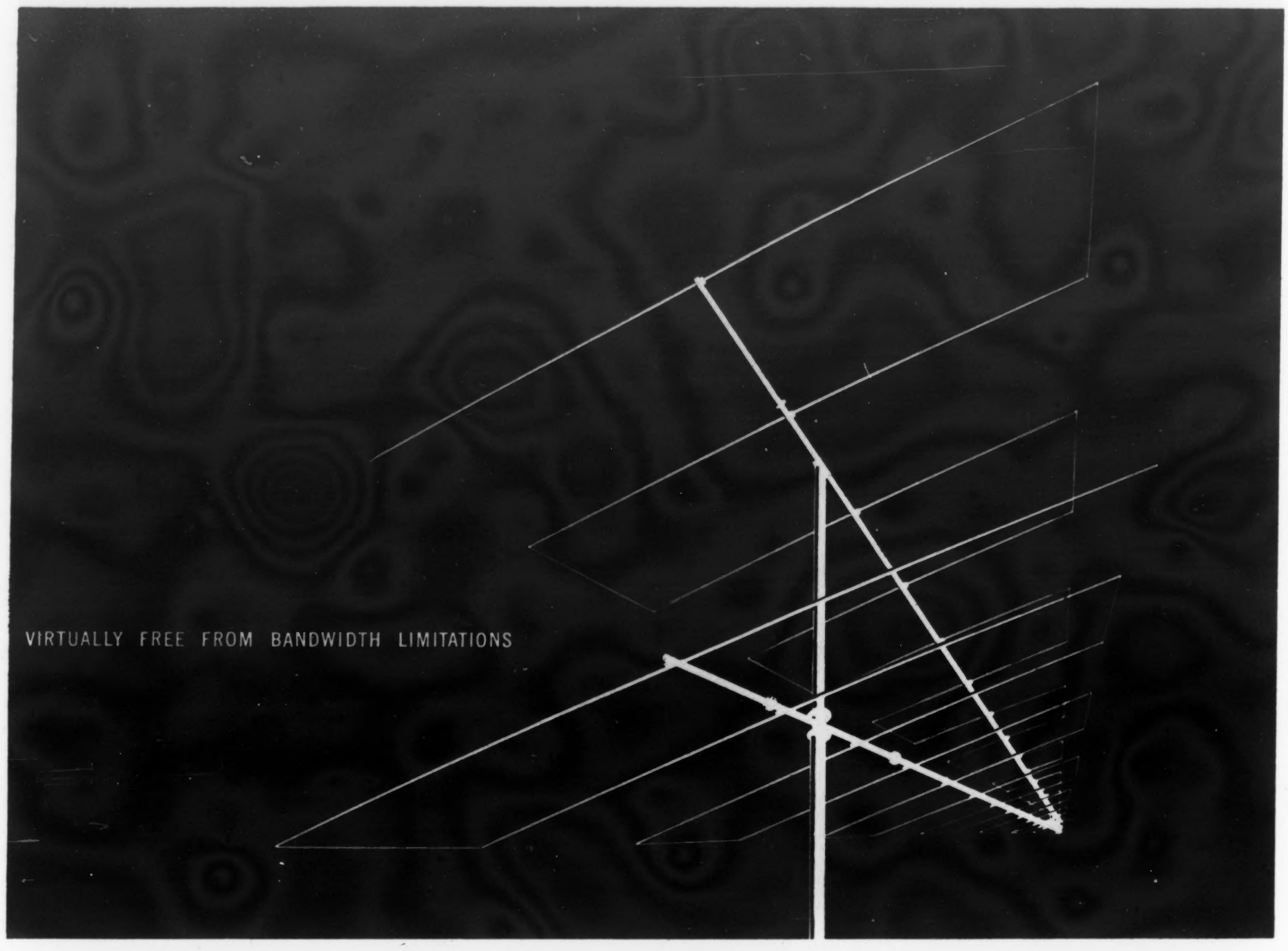


If the design of an equipment is to be optimized, each method of approach must be weighed against reliability, extra engineering effort required, and equipment complexity. Table 1 summarizes this procedure. (Page 13)

Certain design philosophies can be established from the foregoing analysis and by a careful examination of Table 1.

It is at once clear that the system should be fully redundant (group redundancy) to provide the highest degree of reliability with the least extra engineering effort, since neither an all-out vacuum tube improvement program nor a transistorization program will give the desired reliability improvement. However, even a rela-

(*Continued on page* 13)



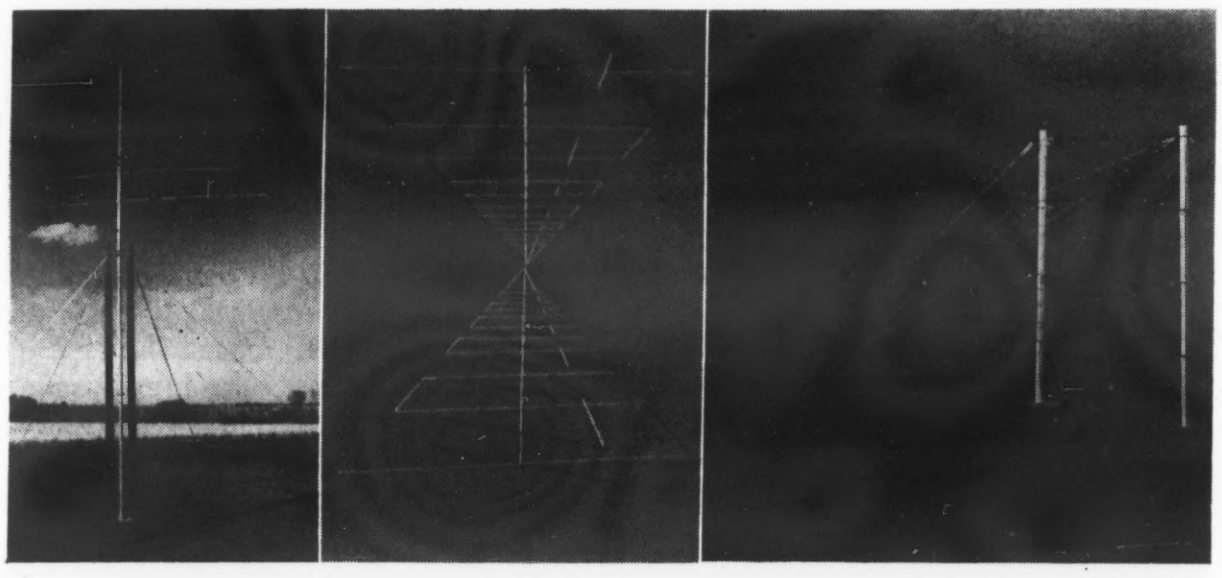
COLLINS LOG PERIODIC ANTENNAS

A radically new approach to broadband antenna design based on the principle of Logarithmic Periodicity has resulted in antennas with radiation patterns and impedance characteristics essentially independent of frequency. One Logarithmically Periodic Antenna can perform the functions previously requiring a large number of antennas, covering bandwidths as high as 10-to-1, with 100-to-1 within the realm of practicality.

The Logarithmic Periodic concept is based on a structural geometry in which the electrical characteristics repeat periodically as the log of the frequency. Since only minor changes occur over each period, and therefore all periods, the characteristics are essentially constant over the whole frequency range.

Typical is the rotatable Collins 237A (above), available for 6.5-60 mc, 11.1-60 mc or 19.0-60 mc. The elements form trapezoidal teeth in two planes of equilateral triangles. Radiation is unidirectional with horizontal polarization, providing a free space gain of 8 db over an isotropic antenna. The VSWR is less than 2:1, and the peak power capacity is 50 kw.

The principle may be used in omnidirectional antennas and in fixed antennas in which the vertical plane pattern is also frequency independent. Some other applications include electronic countermeasures and use as primary feeds for reflector and lens type antennas. Your Collins representative can provide details on these and other applications of this advanced antenna.



COLLINS

237A ANTENNA (left) with unidirectional beam may be rotated to any azimuth for general communication.

OMNIDIRECTIONAL TYPE (center), with horizontal polarization, uses a turnstile arrangement.

FIXED TYPE (right) holds vertical angle of beam independent of frequency for point-to-point circuits.

COLLINS RADIO COMPANY • DALLAS • CEDAR RAPIDS • BURBANK

TABLE I

FACTORS	RELIABILITY IMPROVEMENT	EXTRA ENG. EFFORT	AUTO FAILURE DETECTION, LOCATION	OTHER ADVANTAGES
CONVENTIONAL EQUIPMENT	NONE	NONE	NONE	
VACUUM TUBE AND COMPONENT IMPROVEMENT				
a. QUALITY IMPROVEMENT	LOW	VERY HIGH	NONE	
b. CKT STANDARDIZATION	LOW	MODERATE	NONE	STANDARDIZED COMPONENTS FEWER SPARE PARTS
TRANSISTORIZATION				
a. 100%	LOW	VERY HIGH	NONE	LESS SPACE, WEIGHT LESS POWER REQUIRED LESS HEAT DISSIPATION
b. 30%	LOW	MODERATE	NONE	
SINGLE ELEMENT REDUNDANCY				
a. 50%	LOW	MODERATE	FAIR	
b. 90%	MODERATE	HIGH	GOOD	
c. 100%	VERY HIGH	VERY HIGH	EXCELLENT	
GROUP REDUNDANCY				
a. n = 5	VERY HIGH	HIGH	EXCELLENT	
b. n = 20	HIGH	LOW	GOOD	
c. n = 40	MODERATE	VERY LOW	FAIR	
d. n = 100	MODERATE	VERY LOW	FAIR	

tively slight effort along these lines will yield at least some increase in system reliability. In addition, other relatively simple design procedures will yield further improvements in reliability. Among these are: use of standard components and circuits, transistorization of circuits when it is practical, and avoidance of marginal circuit design. All these serve to enhance the group redundancy technique in providing maximum equipment reliability with minimum additional engineering effort.

Acknowledgement: The author wishes to express his appreciation to Messrs. J. J. Brown and R. W. Crosby for their valuable suggestions and criticisms in the preparation of this article.

Instrumentation

(*Continued from page 8*)

of our working lives. Our children are in school for 12 years, and a large and increasing number of them for four years longer, or even more. A substantial number of our people retire at 65, and many at 60. With a working force of some 65,000,000 and a population of some 180,000,000 each employed person today, regardless of his personal situation at any given period, is supporting himself plus two other persons.

In terms of production only, the goods-producing industries must provide enough to sustain, in addition to their own work forces, the large and growing army of people whose functions are in the nature of service —the professions, the so-called maintenance trades such as the garage mechanic and the paper hanger, and those engaged in personal care as represented by the barber and the cleaning and pressing shop. In 1910, the ratio of production workers to those in service functions was 3 to 1; today, it is one for one, with the service forces including some eight million government workers and a large military establishment.

If our standard of living continues its present rate of increase, each of us 20 years hence will require of the economy the equivalent in goods and services double that which we use today. If we are to reach such a goal, productivity must increase to a similar extent. Since every employed worker today supports himself and two others, this would mean that, in 1978, he would have to produce at current levels twice that amount, or enough to support, in addition to his own doubled consumption, the equivalent of four other persons.

How can the necessary increase be achieved? Certainly not through more human labor. In the next 20 years, the total population is expected to increase by perhaps 40 per cent. The population of working age, however, will increase by less than a third; these are people already born and, therefore, subject to count. The labor force in manufacture and agriculture, with more people going to college than ever and more going into service work, is expected to increase less than 20%.

Longer hours could conceivably supply additional output, but we relinquish our gains in leisure time very reluctantly. It is inconceivable that the trends toward shorter hours, longer vacations, and early retirement will be reversed or that the tendency toward education will be any the less.

If technology does not keep advancing, then we will have to sacrifice somewhere. We will have to make sacrifices either in leisure time, in the number of persons available for services, or in our living standards. We cannot make headway by short-changing one side of our economy at the expense of the other.

You may quarrel as you wish with the figures, and some are admittedly speculative. It is perfectly obvious, however, that the only possible means toward achieving production objectives in line with our national aspirations lies in our technological development.

Continued growth in the direction of improved technology can be no longer regarded as a debatable issue. It is an absolute essential if we are to maintain even our present-day rate of development. And the conditions necessary to this growth must be provided just as surely as the conditions of soil and atmosphere must be provided to produce growth in a field of grain.

In modern instrumentation lies our hope for the extra hands to do the work, the extra effort to make our work effective, the extra energy that will be needed to power our entire economy in an upward climb.

second in a series

TP + RW = TRW

THE MERGER

The legal act of merging two companies into one does not of itself change the sum total of their capabilities. Thus, today the competence of the Ramo-Wooldridge Division for the development of electronic systems for military and commercial applications is indistinguishable from that of its predecessor organization, The Ramo-Wooldridge Corporation, while the skills of the Thompson Products group of divisions in the design and large-scale production of precision devices also remain unchanged. Soon, however, effects of the merger will begin to appear. One early effect will be an important addition of manufacturing strength to Ramo-Wooldridge programs, several of which have passed out of development and are in the prototype or manufacturing phases. Conversely, the special skills of Ramo-Wooldridge scientists and engineers in certain fields can usefully supplement the services that the Thompson Products divisions offer to their customers.

The formation of Thompson Ramo Wooldridge Inc. is intended to provide an unusual capability for the development and production of the complex electronic and mechanical devices and systems required by today's expanding technology.

TRW **Thompson Ramo Wooldridge Inc.**

Main Offices • Cleveland 17, Ohio
Los Angeles 45, California

DIVISIONS AND PRODUCTS

TAPCO: Missile and aircraft auxiliary power systems, ground support systems, fuel systems, pumps, accessories, hydraulic systems, pneumatic systems; electronic control systems, microwave switches; frame structures, pressure vessels. Jet engine compressor blades, rotors, stators, and impellers; turbine buckets, rotors, and stators; structural and fabricated components. Rocket engine cases, nozzles and pumps. Nuclear reactor control rods, pumps, accessories, and core structures. Precision investmen. and continuous vacuum cast parts for aircraft, missiles, jet and rocket engines. Vacuum cast super-alloy ingot, billet and mill shapes.

RAMO-WOOLDRIDGE: Electronic reconnaissance and countermeasures systems, infrared systems, analog and digital computers, air navigation and traffic control, anti-submarine warfare, electronic language translation, information processing systems, nuclear energy applications, missile electronics systems, advanced radio and wire line communications.

AUTOMOTIVE and INDUSTRIAL PRODUCTS: Valves and associated parts for all types of internal combustion engines. Steering linkages, front wheel suspension ball joints, hydraulic cylinders and pumps, cylinder sleeves, piston rings. Truck retarders. Diesel engine turbochargers. Rock drill bits and drill rods. Alloy pistons for automotive and aircraft; impact extrusions, permanent mold and die castings. A wide variety of automotive replacement parts distributed nationally and overseas through 7,000 distributors.

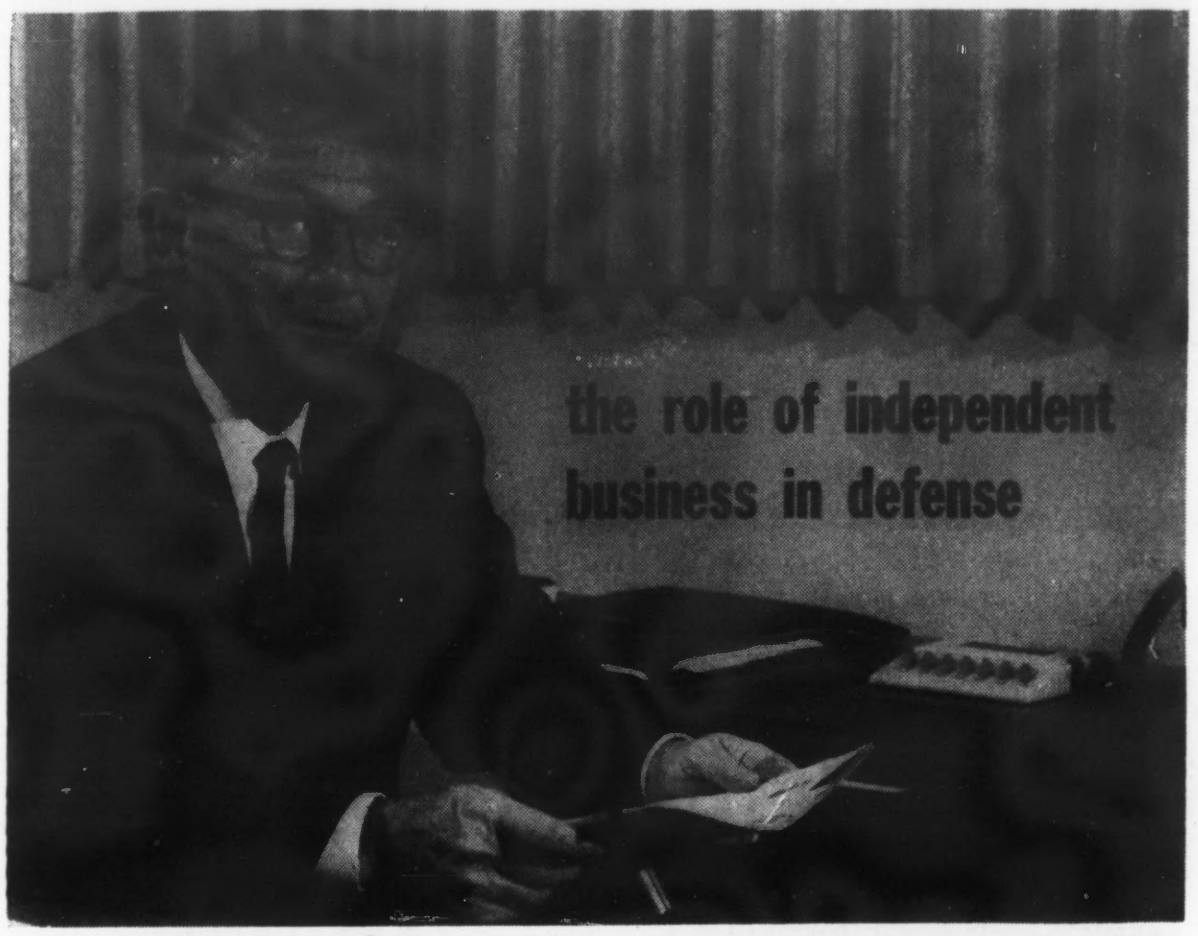
CONSUMER PRODUCTS: High fidelity amplifiers; FM-AM radio tuners; magnetic tape recorders; stereophonic sound systems, public address and intercommunication systems. Television cameras for industrial and broadcast purposes; complete low-power television broadcasting stations.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS CO.: Digital control computers and associated equipment for automatic control of industrial processes, data logging and computation, pilot plant operation and process research, test facility operation, and general computational use.

PACIFIC SEMICONDUCTORS, INC.: Germanium and silicon diodes and transistors, high voltage rectifiers, subminiature rectifiers, voltage variable capacitors.

Number of employees: 22,000
Estimated 1958 Sales: $335,000,000
Plants in Los Angeles, Bell, Culver City and Long Beach, *California.* Denver, *Colorado.* Michigan City, *Indiana.* Cambridge, *Massachusetts.* Warren and Portland, *Michigan.* St. Louis, Manchester and Sullivan, *Missouri.* Cleveland, Euclid, Willoughby, Minerva, and Columbus, *Ohio.* Danville and Harrisburg, *Pennsylvania.* Roanoke, *Virginia.* St. Catherines, *Ontario.*

the role of independent business in defense



by THEODORE C. COLEMAN

President of Strategic Industries Association, the author has had ample exposure to Defense contracting. With two associates, he organized the Coleman Engineering Co. in 1950. The firm specializes in research and development for the military.

MOST "small businessmen" resent the patronizing name tag which has been given them as representatives of defense contractors with fewer than 500 employees. Many come from firms which have grown rapidly out of the "small business" category—and they look back to those days when they had the fun of getting things done before the "law of diminishing returns" began to operate as the organization grew rapidly and became plagued with red tape.

This desire for accomplishment prompted many of the more enterprising to branch out on their own again—out where everyone knows it takes more imagination and nerve to achieve success. They find themselves put in a "pigeonhole," as subcontractors in most cases, where the incentive of the prime contractor is often to "pick their brains" without ample reward.

Fortunately, this is more of a challenge than a genuine complaint and many thousands of smaller and newer firms are finding opportunity in the defense contracting field.

Recognizing that there were many unique problems in dealing with our government, which in most cases applied to large and small business alike, a substantial number of defense contractors with fewer than 1000 employees has been joining the Strategic Industries Association. Started in Los Angeles in 1954 by a handful of the smaller defense contractors, this organization has acquired an able professional staff headed by John Marschalk, experienced in the fields of public and government relations.

Far from a lobby, or pressure group, a remarkably united membership has adopted policies which favor no special group but express the philosophy of "free enterprise."

Basic policies start with the premise that a "free country cannot win against a socialist dictatorship by accepting socialistic practices in its own economy — maximum development and productivity can only be achieved through the use of free enterprise incentives in military procurement."

They are opposed to every form of subsidy and encroachments by government in fields of manufacturing and to every form of government competition against industry.

In industry relations, laws and regulations should foster equal opportunity for a firm of any size to prosper solely on the basis of its quality, dependability and economy. They don't believe that bigness is evil—but it is no guarantee of efficiency. By the same token, smallness is not necessarily virtuous. Anyone with experience in dealing with the government knows that contracting on a broad base takes a much higher degree of judgment than the narrower "weapons systems" concept, where the government is holding fewer firms responsible for a "broad subcontract" program. The administration of this program because of more complex weapons systems was undoubtedly forced upon our military procurement and technical agencies by the scarcity of experienced and competent technical manpower. However, to shift this responsibility to a few, and for the most part very large industrial firms, does not necessarily guarantee utilization of all of the most competent firms. It depends, to a degree, upon the objectivity and caliber of the fewer prime contractors. There is danger of subsidy in this situation unless carefully watched.

It is quite human for a contracting officer, whether acting for the military or a prime contractor, to feel that he will be less responsible if a contract is awarded to a national firm with a "name." If anything should come up to interfere with performance, he feels he will be less subject to criticism. It therefore takes more nerve and judgment, plus more careful investigation, to assign important work to a smaller firm. This is an obvious handicap to the competent and often deserving smaller company. On the other side, many defense contracts require such large resources that the small firm must expect to be disqualified.

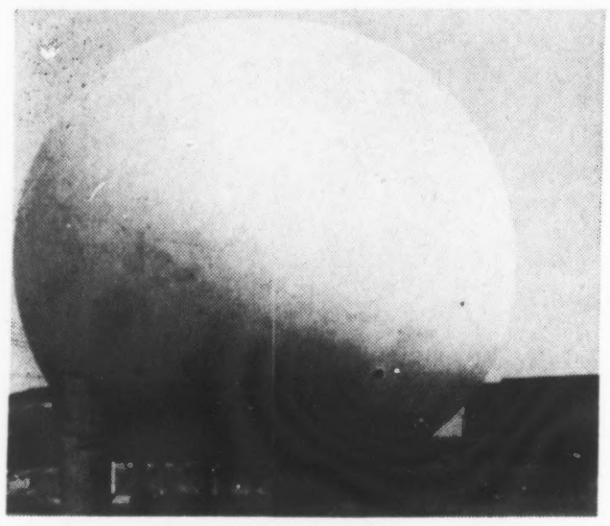
There is no easy answer to this complex problem. Establishing a definite percentage to be set aside for small business is not an intelligent answer. It behooves the smaller firms to qualify themselves as well as to aggressively and truthfully tell the story of their capabilities.

It requires more incentive for capable people to remain in government service—and imposes great responsibility on large prime contractors.

The Strategic Industries Association (S.I.A.) has prepared a booklet on "Where We Stand." This booklet is available to Defense Department officials and to members of Congress. On the subject of advertised vs. negotiated procurement, S.I.A. believes:

"Advertised procurement techniques be restricted to items of common supply for which designs and specifications are either owned by government or in the public domain.

(*Continued on page* 30)



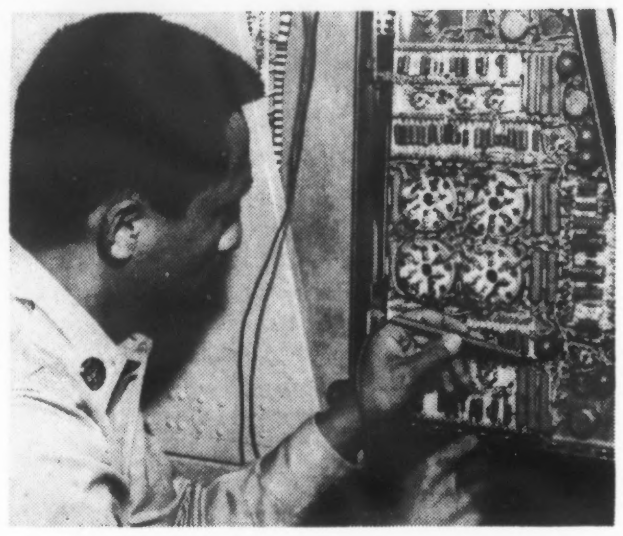
Radome covering the single antenna of FRESCANAR, a new mobile radar system developed for the Army Signal Corps by the Hughes Aircraft Company.

FRESCANAR

A 3-dimensional radar system with frequency scanning

by T. E. GOOTÉE
Office of Technical Liaison
Office of the Chief Signal Officer

Circuit wiring of console section of FRESCANAR, showing use of transistors and arrangement of components for easy maintenance.



A NOTABLE ADVANCE in the science of electronic detection and location of airborne targets is a revolutionary new type of radar—known as FRESCANAR. It is the first radar system to utilize frequency scanning, and the first radar system to compute and display simultaneously the distance, altitude and bearing of aerial targets.

Of singular importance is the mobility of the complete system which consists of an equipment van, power trailers, and a unique antenna contained within a radome. Mobility is essential, because the radar system is to be used for Army air defense by a field army.

FRESCANAR—or *Fre*quency *Scan*ning Rad*ar*—has many important advantages over conventional types of radar equipment.

The system uses a single antenna that rotates *only* in azimuth. There is no mechanical up-and-down motion. The antenna beam scans in elevation by electronic means *without* moving parts.

Highly concentrated energy in the electronic beam provides extreme accuracy, and the beam is moved rapidly and continuously. This arrangement greatly increases the number of targets that can be tracked at the same time, and provides better separation of closely spaced targets with a minimum of ground clutter. Individual targets can also be pinpointed more quickly (fig. 1).

The system computes range, bearing and altitude of aerial targets at the same time. This triple function means a vast economy of time through greater speed of operation.

The system uses only one master console. Most of the electronic circuits are transistorized to reduce weight and bulk of equipment (fig. 2).

These are some of the capabilities and characteristics of the FRESCANAR system—all of them major advantages over conventional, existing types of radar equipment.

The system was developed for the Army Signal Corps by the Ground Systems Division of the Hughes Aircraft Company of California.

Known in Army parlance as the AN/MPS-23, this radar system is the eyes of Missile Monitor—the soon-to-be-announced Army air defense guided missile fire distribution system for mobile use with a field army. Although the complete Missile Monitor will not be in operation for some time, the FRESCANAR system is now ready for operational use with Army air defense missile batteries throughout the world.

An operational FRESCANAR was first displayed publicly in Washington, D. C., during October 1958, when officials of the Army Signal Corps and the Hughes Aircraft Company unveiled this unique type of radar detecting and reporting system.

"This system," said Brigadier General Earle F. Cook, Chief of Research and Development for the Army Signal Corps, "represents a startling advance in radar development. In fact, it is one of the most important advances in electronic detection since the advent of radar, itself, nearly thirty years ago."

Key figure in the technical development of FRESCANAR is Dr. Nicholas A. Begovich, Director of Engineering for the Ground Systems Division, Hughes Aircraft Company.

"This radar system has added important new dimensions to the technological aspects of national defense," states Dr. Begovich, in discussing the research and development of FRESCANAR.

"In the beginning," he continues, "we sought to develop a system having greater ease of maintenance, reduced size and weight, increased mobility and increased speed of operation. On this latter point, we had to increase the rate at which radar surveillance data is obtained—an increase far above the mechanical rate of conventional radar sets."

To achieve this speed of operation, engineers of Hughes Aircraft Company devised the electronic or *frequency scanning* of the radar beam in space without moving the antenna physically. This eliminated the need for special motors, gears, and other mechanical devices—further helping to minimize the bulk and weight of the radar equipment.

Secret of the frequency scanning principle of FRESCANAR, according to Dr. Begovich, is the application of a succession of different control frequencies to the antenna in order to move the beam electronically through a succession of positions in space. Since these controlling frequencies can be varied at the speed of light, the radar beam can be moved far more rapidly than ever possible by physical movement of the antenna. This is the heart of the radar system known as FRESCANAR, and represents the highest degree of current technological sophistication.

"After development of the antenna," continues Dr. Begovich, "associate components were required to complement the new radar technique of frequency scanning . . . again, with due consideration for weight and bulk of equipment, and the continued need for high-speed operation."

Old concepts of semi-manual trigonometric plotting of positioned targets were supplanted by completely electronic three-dimensional representations. Data emerging from the antenna are now programmed by digital means to occupy precisely those successive positions in space which result in maximum accuracy and coverage by the radar system.

Development of the entire FRESCANAR system by the Hughes Aircraft Company covered a period of more than five years.

"The result of our efforts," states Dr. Begovich, "is an essential and important new dimension in national defense geared to the high-speed, high-reaction requirements of modern weapons and missiles."

Employment

The FRESCANAR is an integral part of the Missile Monitor, also developed by the Hughes Aircraft Company. The Missile Monitor is the Army air defense guided missile fire distribution system, and operates much in the following manner in combat.

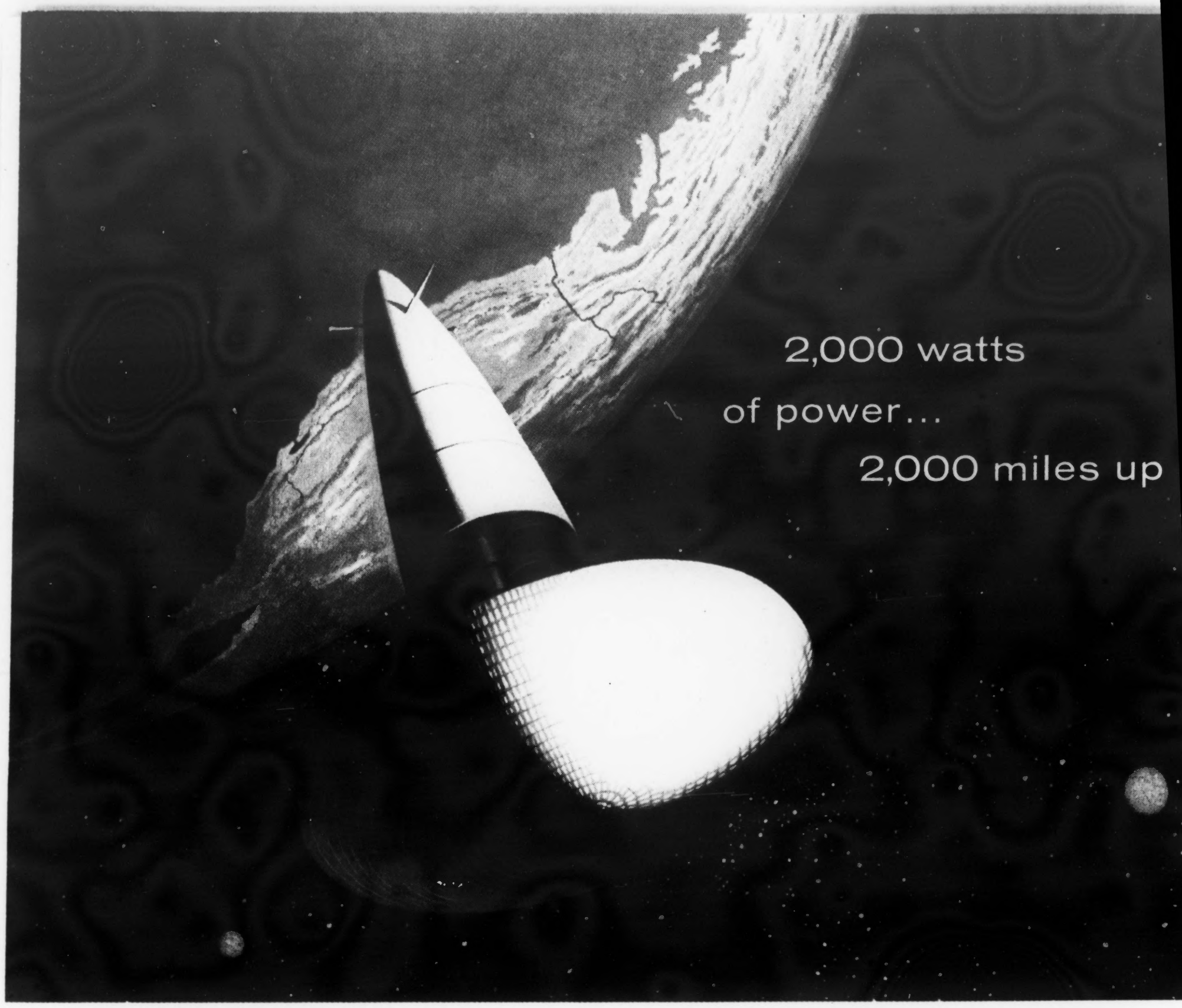
Aerial targets are detected and located by FRESCANAR, and this three-dimensional information is fed electronically to a *Radar Processing Center*. There the visual target information is converted to digital data and transmitted to a *Weapons Monitoring Center*, several *Battalion Operations Centers*, and various *Weapons Battery Terminal Equipments* (at missile launching sites) — all part of the Army Missile Monitor.

The group commander at a *Weapons Monitoring Center* has complete information on aerial targets in his particular area, and he can select and assign targets to appropriate weapons batteries. All necessary information is provided these batteries to fire missiles—such as the Nike-Hercules, Nike-Ajax, or Hawk — at airborne targets.

Use of FRESCANAR in this arrangement greatly increases Army air defense capabilities for the field army since it provides the army commander with a single device that can detect and accurately plot the range, the speed, the direction, and the height of one or more aerial targets simultaneously. Resultant data are provided almost instantaneously to Army air defense missile weapons batteries for appropriate distribution of missile fire.

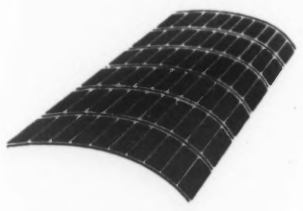
A single radar for this purpose helps to decrease the amount of tactical equipment, the required logistical support, and the number of operating and maintenance personnel in the field army area. This is important for both conventional and nuclear warfare.

"This new radar system," states Dr. Begovich, "provides the Army with new capabilities to cope with the changing, high-speed tactical situations of the air defense patterns of tomorrow's warfare. In this way, frequency scanning radar definitely extends the potentials of our Nation's most critical area today."



Hoffman solar cells—lasting thousands of years—convert sunlight into electricity to supply power for satellites and space vehicles during entire orbital life.

Highly efficient silicon solar cell converts up to 10% of the light energy striking it into usable electrical power.



Typical solar energy converter. A panel of solar cells of approximately 20 square yards can produce 2,000 watts of electricity.

How much electrical power do you need to run a satellite's transmitter or instrumentation system, or furnish operating power for a manned space station? 5 milliwatts? 2,000 watts? Whatever power you'll need up there—out of reach of conventional energy sources—you'll be able to get . . . direct from the sun!

Solar energy converters, capable of delivering 2,000 watts or more, are now feasible as power sources for inaccessible and remote places.

Hoffman silicon solar cells, used in these converters, are the most practical and efficient means yet developed for converting solar energy into electricity. Already proved in the U. S. Navy's *Vanguard* satellite, Hoffman solar cells will continue to power its radio transmitter as long as it orbits the earth.

Hoffman Electronics
CORPORATION

HOFFMAN LABORATORIES DIVISION / 3740 South Grand Avenue, Los Angeles 7, California

Missile Support Equipment · Radar · Communications · Electronic Countermeasures · Navigation
Semiconductor Applications · Electro-Mechanical Equipment · Weapons Systems

For more information, write Dept. 14, Hoffman Laboratories.

Silicon solar cells—by Hoffman—the key to today's and tomorrow's problem of power in outer space.

— GOVERNMENT —

REVOLUTIONARY NEW TELETYPEWRITER A teletypewriter, believed to be the fastest general purpose message printer in communications history and capable of typing at a rate of 3,000 words a minute, has been developed by the U. S. Army Signal Corps and the Burroughs Corp. It prints four full lines of text a second, which is 50 times faster than a news service teletypewriter, 45 times faster than an average typist, and 20 times faster than the average person can talk. Instead of using ordinary keys, the letters are shot at the paper electronically by a bank of electrode "guns."

AMOUNT OF WATER ON MARS A special electronic tube developed by International Telephone and Telegraph Corp. may be the "key" in an upcoming Navy test to determine if there is enough water on the planet Mars to support life. The tube is of a type called a multiplier phototube, which converts light into an electrical signal and amplifies that signal two million times. The tube has been installed by the Office of Naval Research in a 16-inch telescope to be trained on Mars from a balloon 80,000 feet above earth where earth's atmosphere will not interfere with the measurements.

SUBMARINE "EYES" The Navy is installing a "far-reaching and highly sensitive" submarine detection system in 350 of its long-range NEPTUNE patrol planes. The use of the new gear "will greatly enhance early detection of enemy submarines by making it possible to locate underwater craft at greater ranges than ever before," the Navy said., The fabrication, assembly and installation of the system is being made by Lockheed Aircraft Corporation under a $36-million contract.

CONTRACTS: ARMY: Microwave Associates, Inc., variable capacitance microwave silicon varactors, $100,000; Western Electric Co., production of electron tubes for guided missile fire control systems, $1,070,901; Stelma, Inc., communications equipment for furnishing 88 telegraphy monitors, $1,462,551; Adler Electronics, Inc., design and manufacture of single sideband communications systems, $932,000; Philco Corp., design and build two medium size, mobile electronic data processors to be called Basicpac and Logispac, over $1,000,000. NAVY: Douglas Aircraft Co., Inc., production of A4D-2N SKYHAWK aircraft, $79,000,000; Universal Match Corp., engineering and coordination of TERRIER anti-aircraft guided missile launching equipment, $2,100,000; Lockheed Aircraft Corp., development and installation of a new submarine detection system on NEPTUNE patrol planes, $18,000,000; The Martin Co., production of the air-to-surface BULLPUP guided missile, $20,400,000. Air Force: Datatape Div. of Consolidated Electro-Dynamics Corp., magnetic tape recorder-producer equipment to be used with range instrumentation, $216,900; Hoffman Electronics Corp., development and production of improved TACAN air navigation equipment, $33,000,000; American Machine & Foundry Co., design and development of underground launching system for the top priority TITAN intercontinental ballistic missile, $29,300,000; North American Aviation, Inc., Missile Development Division, production of GAM-77 air-to-surface missile, $18,928,000.

— INDUSTRY —

A "FUEL CELL" smaller than a basketball that is capable of turning chemical energy directly into electrical power with unprecedented efficiency has been developed by the Missile Systems Division of Lockheed Aircraft Corp. The cells can be built to produce 10 to 30 times as much energy as a conventional automobile battery with twice the efficiency of a steam engine, a company official reported. Lockheed predicted that the first commercial application of the cell would come within two years, probably in the field of communications and in 5 to 10 years in the transportation field.

NEW MOTOROLA DEPARTMENT The Military Electronics Division of Motorola, Inc., has established a solid-state electronics department in Phoenix, Arizona. This new department is to facilitate the development and manufacture of microwave ferrite materials and the development of microwave control devices.

ELECTRONIC MAGAZINE LABELING SYSTEM The Curtis Publishing Company of Philadelphia, has purchased a Stromberg-Carlson electronic printer for use in printing address labels for magazines. The equipment is a S-C 5500 high speed electronic label printer combined with a M-60 auxiliary editing buffer. It will be capable of printing over one million address labels per eight-hour day, printing labels up to ten times faster than existing electro-mechanical printers.

ALASKAN SUBSIDIARY Federal Electric Corporation has established a new subsidiary in Alaska, Northern Services, Inc. The company will provide field support in the maintenance and operation of the 3100-mile "White Alice" Telephone and Telegraph network in Alaska. Insofar as possible, more than 250 employees are to be hired locally as a supporting force for this longest and most modern Over-The-Horizon-communications system.

WESTINGHOUSE'S NEW AUTOMATIC TELETYPEWRITER NETWORK is said to be the world's largest automatic communications system ever installed for an industrial firm. The network links 102 plants and 142 sales offices of Westinghouse Electric Corp. and includes 23,750 miles of circuits leased from AT&T. It is estimated that the system will handle over 670,000 words per day. The Bell System provided the network equipment for this coast-to-coast system which was installed over a period of 18 months.

— GENERAL —

PHOTO CONTEST All military personnel on active duty for 90 days or more may compete this year in the 1959 All-Army and 8th Interservice Photography Contest, according to Department of the Army Circular 23-18. Competition will be in two groups: Group I, black and white single photographs and Group II, color transparencies. The Department of the Army level of competition will be judged in May 1959, with local competition coming somewhat prior to that time, and the interservice contest during June.

ELECTRONIC SNOW GAUGE A newly developed electronic-telemetering system for measuring the water content of mountain snowpacks is being installed in a remote area of California's rugged Sierra Nevada mountains. The system, developed by the U. S. Army Corps of Engineers and Sierra Electronic Corp., a subsidiary of Philco Corp., will be placed in operation this winter. The unique snow gauging equipment, based on a radiation detector of the scintillation type, enables engineers to obtain accurate hydrological data (water content of snow) from remote, unattended areas. This information is extremely useful in the planning and operating of irrigation projects, flood control programs and hydroelectric plants.

A NEW TECHNICAL SOCIETY, The Society of Aircraft Materials and Process Engineers (SAMPE), Eastern Division, is being formed, to complement a similar group existing on the West Coast and in the Southwest. Quarterly meetings are planned which will consist of technical presentations and discussions. Membership will include engineering personnel of the aircraft and missile industries as well as of companies either directly or indirectly serving these industries. For further information write to: John S. Thorpe, Application Development Engineer–Aircraft and Missiles, Allegheny Ludlum Steel Corp., Bell Bldg., Tarentum, Pa.

A SUPPLEMENT TO "INVENTIONS WANTED BY THE ARMED FORCES" has been released by the U. S. Department of Commerce. Included in a list of 82 new technical problems which the armed forces would like to have solved by civilian inventors are transistors which will operate satisfactorily in the HF, VHF and UHF at temperatures over 150° C. and a means for communicating over a wire line, even though the line is physically broken. Both the supplement and original list may be obtained from the National Inventors Council, Department of Commerce, Washington 25, D. C.

"THE ALPHABET CONSPIRACY" is the title of the next program of the Bell System Science Series to be telecast on Monday evening, January 26, over NBC. This show deals with the scientific study of language as the medium of communication between human beings and will be especially interesting to people in the telephone business.

CALENDAR OF EVENTS:
JANUARY 12-14: The Fifth National Symposium on Reliability and Quality Control in Electronics is to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa. and is sponsored by IRE, EIA, AIEE and ASQC. To permit a longer discussion period, a short extemporaneous coverage of the highlights of papers will be given. Four special tours have been scheduled and an interesting ladies' program.

DECEPTION IS A FORM OF COUNTERMEASURE

and at this the chameleon must be considered an expert.

The approach to the problem of survival through countermeasures has been neatly solved by this handsome little fellow. By simply changing his color to match the surroundings the chameleon may take on the appearance of a brown twig, a green leaf or so completely blend into the immediate area that his enemy is hopelessly confused. This, in effect, is countermeasure in the truest sense.

To confuse or mislead the enemy is often the problem faced by the military. Not to be outdone by the chameleon, electronic countermeasures have been developed which effectively confuse the presentations as seen on radar scopes. Defensive action is thereby delayed until too late. In this field, as well as many other forms of countermeasures, Instruments for Industry can apply exacting know-how and skill. The high degree of success achieved by IFI is proof of ability.

Only one target is a true target.
The big question . . . which one?

MILITARY INSTRUMENTS ifi INC. FOR INDUSTRY ELECTRONICS

INSTRUMENTS FOR INDUSTRY, Inc.
101 New South Road, Hicksville, L. I., N.Y.

Graduate engineers with two or more years of circuit application in the fields of electronics or physics are invited to meet with Mr. John Hicks in an informal interview or send complete resume to: Dir. Personnel, IFI, 101 New South Road, Hicksville, New York.

A TRIP TO MARS

by
Dr. H. V. Hawkins
Assistant Director and Head of Aero-Dynamics Section, Cook Technological Center

"INTERPLANETARY Airlines, Flight 1 for Mars and all intermediate points up, now ready at Gate 4." This may well be the call of the conductor at a rocket launch station a few years hence. Though you are all amused as such a thought, you are not nearly so startled at such a prediction as you would have been just before Sputnik I on October 4, 1957, only slightly over a year ago.

Yes, it has only taken the public a year to become reconciled to the realization that we've entered the space age. We, at Cook Electric Company, as well as a few others actively engaged in the missile business, have known and accepted this for a much longer time.

Our universe is a fantastic one—a universe that is unfolding its wonders to us at an ever-increasing rate. I've recently returned from attending the "Second International Symposium of the Physics and Medicine of the Atmosphere and Space." Over 700 attended this symposium. You are going to see an amazing next ten years.

Even yet I do not feel safe in embarking upon the engineering details of our trip without first showing you why this journey is now possible. Only a critical review of the history of scientific and engineering developments will convince you that we could now be ready technically. Whether we are ready economically is the problem of the economists — bless them—and it has never been the way of life for them to stop us for long. Such developments follow the same natural laws as the tides and the seasons. We, in this country, cannot afford to take the chance of failing to accelerate our technical development to its highest, for fear Russia may excel and dominate us.

Let's look at how we find ourselves in this state of development now in 1958. Figure 1 shows a "Chronology of Technical Progress." Note the ever increasing crescendo of progress. Each development itself makes possible several more. All of you know the game of starting with one penny; doubling your money each day would give you $5,000,000 in 30 days. Technical progress is very much like this. Note, that "our" world really started in about 1800. The science of modern chemistry, structural analysis, medicine, including the germ theory of disease, electricity and electronics and methods of locomotion and communication have developed since then though this is less than 2 centuries in a modern calendar of 20 and an ancient calendar which science believes shows that man has existed for about 20,000 centuries. Yes, it's taken us a long time to become "civilized" but in 2 more centuries our time will certainly be looked back upon as almost a cave man era.

We are all getting used to the phrase "technological breakthrough." It's so common that often times we confuse the real thing with just an ordinary extension of engineering principles to the design of a new contraption. If, with his slide rule, the engineer can project a planned course of development within the "state-of-the-art," a breakthrough is not involved. To get the job done it is only necessary to fire the starting gun (that is write and implement the contract) and await the results, knowing full well ahead of time that it is possible.

You know that man can make a satellite. You feel pretty sure that we can send a rocket to the moon. We've almost done it with the Pioneer ascending to 80,000 miles or ⅓rd of the distance. Reports are that it lacked only about 580 miles per hour of the 23,870 mph required.

Moreover, on October 15, 1958, an unofficial news release indicated that the USAF had been authorized to launch two more space probes of which one might be to Venus, 26,000,000 miles away. Whether or not this is true is not important because it could be true.

Our trip to Mars is, thus, not a fantasy of the 1930 Buck Rogers version. It is one of the 1958, Wehrner von Braun type, taken from a book

(*Continued on page 24*)

HIGH VOLTAGE, GLASS-ENCASED

DIFILM® VITAMIN Q® CAPACITORS

New leakproof dual dielectric design meets severe life tests ... withstands high altitude applications

HIGH-ALTITUDE and HIGH-VOLTAGE capacitor applications in airborne electronic equipment are simplified with Sprague's new Type 205P Difilm Vitamin Q capacitors! These glass-encased, dual-dielectric capacitors are specifically designed to minimize corona problems.

In addition to their use in airborne equipment, Type 205P capacitors also find application in high-voltage ground equipment, including power supplies for transmitters, induction heating equipment, and electro-static precipitators ... as well as in coupling and bypass applications in various industrial electronic control devices and allied equipment.

Ruggedness and dependability are built right into these capacitors. Special, heavy-walled tempered glass housings encase the capacitor sections. A new end-seal design and a sealing technique eliminate the plague of impregnant leaks associated with other glass-encased capacitors. The dual dielectric used in Type 205P units results in capacitors with the best electrical properties of both polyester plastic film and the highest grade kraft condenser tissue. The outstanding electrical properties of Vitamin Q, Sprague's exclusive inert synthetic impregnant, are well known.

Type 205P capacitors are available in standard catalog ratings up to 10,000 volts for both 85°C and 125°C ambient temperatures; higher voltage designs are furnished to meet your special application needs.

For complete technical data, write for Engineering Bulletin No. 2312 to Technical Literature Section, Sprague Electric Company, 287 Marshall Street, North Adams, Massachusetts.

SPRAGUE®
the mark of reliability

SPRAGUE COMPONENTS:
CAPACITORS • RESISTORS • MAGNETIC COMPONENTS • TRANSISTORS • INTERFERENCE FILTERS • PULSE NETWORKS
HIGH TEMPERATURE MAGNET WIRE • CERAMIC-BASE PRINTED NETWORKS • PACKAGED COMPONENT ASSEMBLIES

(Figure 1) *CHRONOLOGY OF TECHNICAL PROGRESS*

DATE	MAN	DEVELOPMENT
200 BC	Archimedes	Specific Gravity
100 BC	Hero	Jet Propulsion
160 AD	Lucian	Wrote of Trips to Moon
1500	da Vinci	Sketches of Flying Machines
1543	Copernicus	Astronomical Concepts
1550	—	Railroad—Wooden Rails—Horse-Drawn
1630	Kepler	Laws of Motion on Planets
1642	Galileo	Motion of Earth
1727	Newton	Laws of Motion
1769	Watt	Practical Steam Engine
1774	Priestley & Lavoisier	Discovered Oxygen and Established Basis of Modern Chemistry
1804	Trevithick	Steam Locomotive
1807	Fulton	Steamboat
1820	Cecil	Gas Engine—Hydrogen—Air Basis of Modern Chemistry
1835	Navier	
1860	Lenoir	Gas Engine—Street Lighting Gas
1864	Marcus	Gasoline Engine and Crude Automobile
1879	Edison	Electric Light
1881	Pasteur	Germ Theory of Disease
1885	Daimler & Benz	Automobile and Motocycle
1886	Hertz	Electric Transmission in Ether
1903	Wright Brothers	Powered Aircraft Flight
1903	Fleming	Vacuum Tube—Diode
1904	De Forest	Vacuum Tube—Triode
1925	(Carnegie Institute)	Radar—Pulse Ranging
1938	Hahn—Strassman	Uranium Atom Split
1942	Fermi	Atomic Pile
1944	von Braun	V-2 Guided Missile
1945	(AEC)	Atomic Bomb
1947	(Bell Aircraft)	Supersonic Flight
1954	(AEC)	Commercial Atomic Power Plant

ORBIT OF DEPARTURE

Period of Revolution	2 hours
Orbital Radius	5,050 miles
Altitude Above Earth	1,070 miles
Orbital Velocity	15,800 mph

(Figure 2)

written by Dr. von Braun and published by the University of Illinois Press.

I've drawn up enough of that source's figures to show you the principal factors of the trip, converting the metric centimeter, gram and second terminology of the author to our foot, pound and second units. The types of fuels that these calculations were based upon and the exact configurations of the vehicles are not given. The figures are intended to show the order of magnitude of the project.

The basic plan calls for the establishment of a satellite space station (Figure 2) at an elevation of 1070 miles above the earth, so as to have a 2-hour period of revolution about the earth. This will be the "Orbit of Departure" in which we will store all of the materials required to make the trip. Here the 10 interplanetary space vehicles will be assembled and fueled. It takes a lot of energy to get materials up there, but once there no effort is required to keep them there. Thus, such a station is a natural jumping off point. The orbital velocity of 15,800 mph is a long way toward the escape velocity required to leave the immediate vicinity of the earth. The choice of a 1070 mile orbit may not have been a wise one. At this altitude the radiation level may be excessive for long residence by men. However, the specific altitude chosen is not too important.

To get into the orbital position a three stage rocket-powered guided missile is required that is not unlike our present IRBM or ICBM though several times larger. To ease the economic load the stages are to be recoverable and reuseable.

Perhaps I might point out that one of the major problems in such a large scale operation as this will be maintenance of communications. In fact, this is no small problem for our normal business world when everything is close in toward the surface and on the surface. In the same way that an orbital station can act as the starting point for a "Trip to Mars" such stations can be used as information relay stations. Three located at 120° intervals around the earth at the same elevation will ultimately serve to give world-wide telephone, television, and even mail service. The cost of these stations will be lost in the tremendous potential benefits they can provide. One typical side benefit is to serve as accurate bench marks for navigation on the high seas and in the air in all types of weather. It takes vision to embark upon such a development—the type our country has always displayed.

MARS TRIP PLAN

72 Man Expedition
260 Days in Transit Each Way
400 Days on Mars
10 Ships Total
- 3 Descend to Mars
- 7 Return to Earth's Orbit

950 Ferry Missions to Earth's Orbit
49 Ferry Vessels
$500 Million for Ferry Fuel
$3.5 Million for Mars Fuel
Ship Size
- Length 196 Feet
- Diameter 64 Feet
- Total Payload 87,000 Pounds
- Dry Payload 55,000 Pounds

(Figure 4)

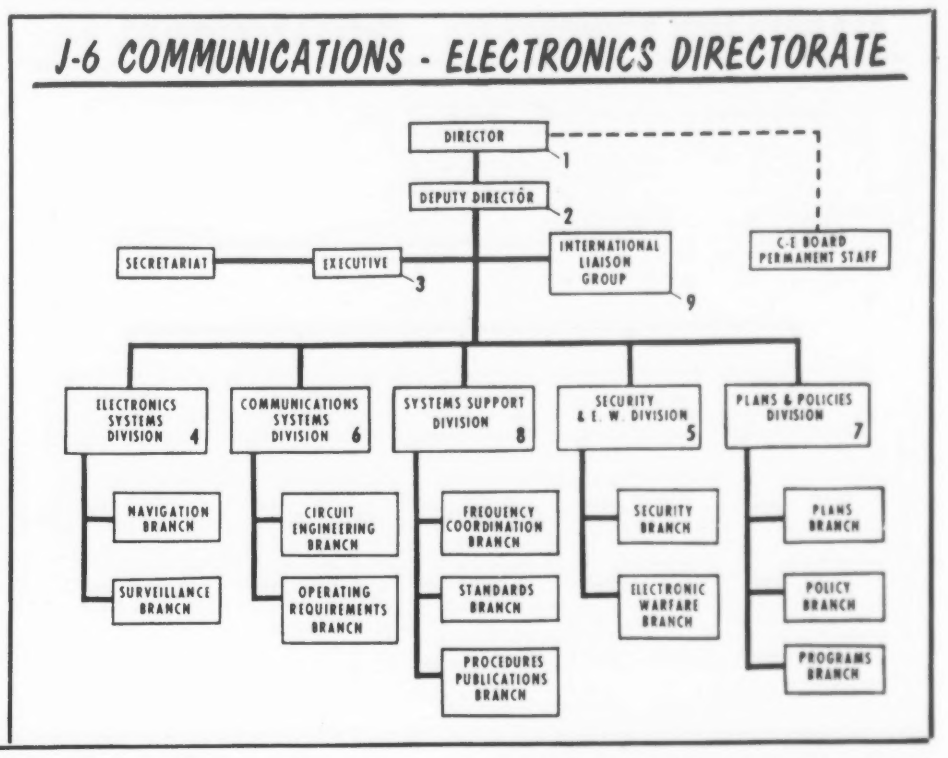
(Figure 3) *TRAJECTORY DATA*

STAGES		1st	2nd	3rd	Adaptation Maneuver
Thrust	Lbs.	28,200,000	3,530,000	441,000	441,000
Take Off Weight	Lbs.	14,120,000	1,985,000	287,000	173,000
Empty Weight	Lbs.	1,543,000	154,000	48,500	147,000
Final Weight	Lbs.	3,530,000	441,000	173,000	147,000
Propellant Weight	Lbs.	10,600,000	1,540,000	183,000	26,000
Burning Time	Sec.	84	124	73	17
Cut Off Altitude	Miles	25	40	63	63
Cut Off Velocity	MPH	5,250	14,360	18,480	+1,030
Cut Off Distance	Miles	31	332	656	1,000
Angle of Trajectory to Horizontal	Degrees	20.5	2.5	0	0
Diameter	Feet	64	64		
Length	Feet	90	46		

Specific information about the vehicles is shown in Figure 3. The primary difference from our present missiles is one of size. Figure 4 shows the basic flight plan that would be followed. Ten ships would be assembled and outfitted in the orbital station. These ships need not have a clean aerodynamic appearance because there is no significant atmosphere to cause drag. They would be large tanks, motors, and chambers tied securely together so that each ship would travel as a unit. Even at

(*Continued on page* 31)

Charter of the J-6 (Communications-Electronics) Directorate of the Joint Staff



1. Maj. Gen. James Dreyfus, USA. 2. RAdm. J. S. Dorsey, USN. 3. Col. B. H. Perry, USAF. 4. Col. I. F. Stinson, USAF. 5. Col. N. L. Tittle, USA. 6. Col. R. F. Frost, USAF. 7. Col. S. S. Cerwin, USA. 8. Capt. T. A. Torgerson, USN. 9. Capt. R. R. Hay, USN.

SIGNAL *is indebted to Major General James Dreyfus, USA, Director for Communications-Electronics, Joint Staff, for his cooperation in arranging for this article. General Dreyfus, a long-time member of AFCEA, is ably assisted by his Deputy Director, Rear Admiral J. S. Dorsey, USN, who served as one of* SIGNAL*'s Contributing Editors before taking his present post at the J-6 Communications-Electronics Directorate.*

THE DIRECTOR for Communications-Electronics (DCE), J-6 is charged with providing assistance to the Joint Chiefs of Staff in communications-electronics planning in support of strategic and operational concepts, and exercises staff supervision of and control for the Joint Chiefs of Staff of joint communications-electronics operations in support of commands established by the Secretary of Defense.

To be directly responsible to the Director, Communications-Electronics, Joint Staff, the Military Departments have organized a Military Communications-Electronics Board not included in the structure of the Joint Staff. In its responsibility to the DCE, the Board will assist in the preparation and coordination of detailed and/or technical joint and combined directives and/or agreements in the following communications-electronics areas: operating procedures and instructions, publications, equipment characteristics and standards, frequency allocation and assignment and other matters which may be referred to it.

Under the new terms of reference, the Military Communications-Electronics Board, along with J-6 Directorate, will absorb the previous functions of the Joint Spectrum Evaluation Group which will be dissolved after making its report on Tasks II through VI inclusive.

Organization

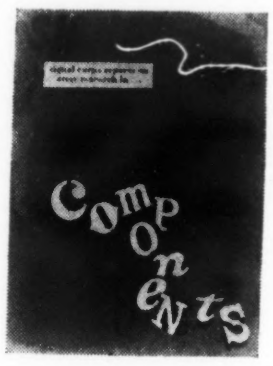
The Directorate shall consist of the Director for Communications-Electronics, a Deputy Director, an Executive Officer and appropriate subordinate divisions, branches and sections. The Director, in addition to his other duties, shall chair the Military Communications-Electronics Board.

Functions

Subject to the authority and direction of the Chairman, Joint Chiefs of Staff, and the Joint Chiefs of Staff, the Director for Communications-Electronics shall have the authority and responsibility for, and shall perform the following duties:

- Advise the Joint Chiefs of Staff and other appropriate agencies of the Department of Defense on communications- electronics matters.
- Prepare joint communications-electronics studies, plans and policies, as required. This includes, among other things:
  - (1) Electronic Warfare, to include communications and electronics active and passive countermeasures and counter-countermeasures.
  - (2) Communications Security, collaboration with the Intelligence Directorate (J-2) as required.
  - (3) Communications portion of Communications Special planning in collaboration with the Plans and Policy Directorate (J-5) and, as required with the Intelligence Directorate (J-2).
  - (4) Collaboration with the Intelligence Directorate (J-2) as required on matters pertaining to Communications Intelligence (COMINT).
- Review the communications-electronics plans prepared by the commanders of commands established by the Secretary of Defense.
- Monitor the implementation of approved joint plans, doctrines and Department of Defense policies related to the communications-electronics activities of the Military Departments and the commands established by the Secretary of Defense.
- Make recommendations as to the communications-electronics support required by the Secretary of Defense and the Joint Chiefs of Staff for the exercise of command.
- Review, coordinate and consolidate requirements for military communications-electronics systems, facilities and services in support of joint strategic and operational concepts.
- Recommend to each of the Military Departments responsibilities in connection with the programming installation and operation of communications-electronics systems and facilities to meet military requirements.
- Monitor the provision of communications-electronics support assigned to the Military Departments by the Secretary of Defense and the Joint Chiefs of Staff.
- Conduct studies as required to coordinate the point-to-point voice, teletypewriter, facsimile and data transmission facilities of the Military Departments in order to insure adequacy of joint communications services.
- To meet Department of Defense requirements, make recommen-

(*Continued on page* 31)



ATTENTION

SIGNAL

READERS

Today systems and equipments are the end product of our military electronic research and development.
To achieve significant improvements in the equipments we have acquired to date, the magnitude of work required in the area of electronic component development far exceeds the expectations of most of us. To present a more comprehensive picture of this area,* SIGNAL Magazine will feature a series of timely and informative articles in the March issue entitled, "The Signal Corps Reports on Army Research in Components."

Among other items carried in this timely series will be:
- Power supplies from the common Leclanche cell to radically new nuclear batteries with power drains running from milliwatts to kilowatts.
- Miniaturization from the Handie-Talkie of the Korean War to the match box size radio of tomorrow.
- Some speculation on the impact of micro-miniaturization on commercial applications.
- Promising techniques in the Signal Corps Micro-Module program.
- Passive parts such as new types of resistors, capacitors, ferrite devices and improvements in relays and connectors.

SPECIAL MARCH ISSUE ON COMPONENTS

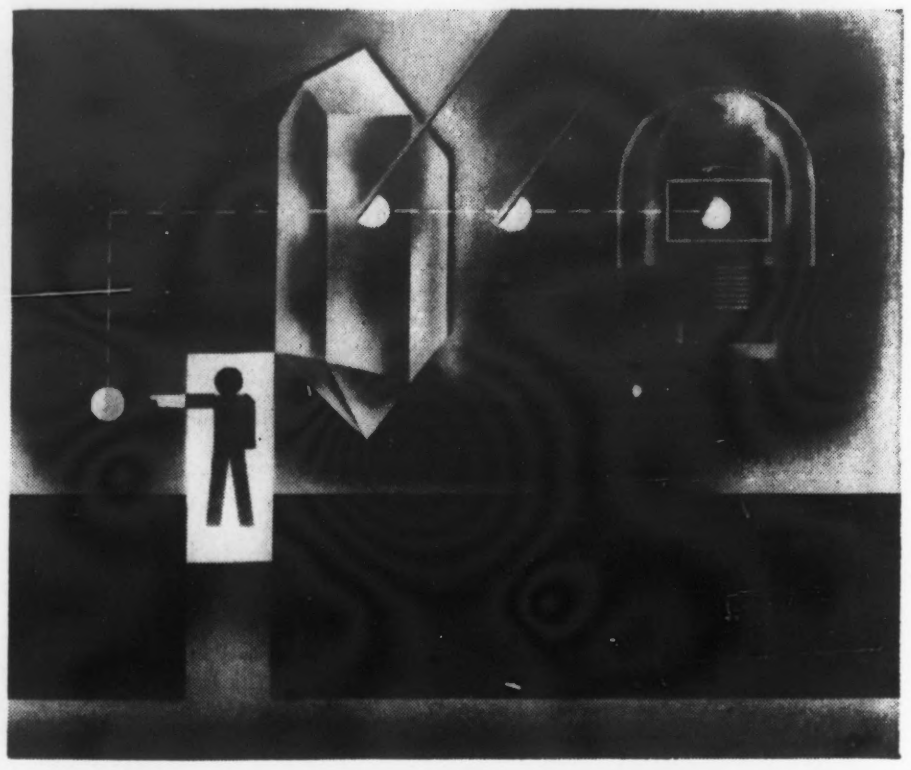
- Electron devices with emphasis on tubes and transistors.
- New devices such as the MASER and parametric amplifier.
- Molecular engineering, high pressure research and ultra pure materials.

A vigorous research program exists in support of the general components development field. In the special March issue, we aim to present a well-documented picture of the vastness of this area and its importance in future electronics systems and equipments. This is feature material that the military-industrial team, educators, researchers and production engineers will want to read and retain.

THE EDITOR

**If you missed our first announcement on this important series, recheck your December issue.*

MISSILE COMPONENTS Bulova's infra-red seeker cells are designed to lock any missile on target; Bulova's fuzing systems do the rest. Powder-driven gyros, timers, safety-and-arming systems and other electronic and electro-mechanical devices, designed and made by Bulova, play vital roles in the Sidewinder, Dart, Talos... in all, 18 key missiles.



AUTOMATION Bulova R&D designed mechanized plant and equipment for Signal Corps goal of 10,000 perfect quartz crystals per 8 hour shift —with 1/10th the manpower. From systems analysis through equipment development, Bulova engineers devise industrial and military facilities for automatic production of electronic components and ordnance items.

Bulova precision helps to solve today's most challenging problems

Time, mass, length... the age-old concepts man relies on as he enters the Age of Space.

Time alone is unique. Its accurate measurement demands the highest order of precision in the design and manufacture of electro-mechanical devices.

Bulova, leader in measurement of time, has become master of the very combination of abilities that holds practical solutions to the growing challenges of miniaturization.

Miniaturized systems and components by Bulova are now working for our nation's defense and automated industry. The same vision and experience that developed them are available to assist you... from concept to reliable mass production.

For full information, write *Dept. G.I.S.-1, Bulova Park, Jackson Heights, New York.*

BULOVA
watch company

BULOVA RESEARCH AND DEVELOPMENT LABORATORIES, INC.

PRECISION MANUFACTURING Bulova-built servo muscles steer our nation's first ballistic guided missile — the Corporal. When critical tolerances demanded uncompromising accuracy, Bulova solved tooling and assembly problems on a crash basis. Bulova experience and facilities are unexcelled where precision, reliability and capacity are vital.

AIRCRAFT INSTRUMENTS Bulova's new Servo Altimeter combines unsurpassed sensitivity and accuracy with direct-reading tape presentation. Special pressure devices created by Bulova include transducers for air data computers... remote pressure sensors for weather stations and airports... climb and dive indicators... and autopilot altitude controls.

photoprogress

by FRANK SMITH
SIGNAL PHOTO EDITOR

Ultra-High Speed Photography—Pictures at Five-Billionths of a Second!

A development of broad implication in ultra-high speed photography is the Kerr cell camera developed by Electro-Optical Instruments, Inc., Pasadena, Calif., under a U. S. Army Ordnance contract for the Samuel Feltman Ammunition Laboratories, Picatinny Arsenal, Dover, New Jersey, according to A. M. Zarem, President of the company.

The novel feature of this ultra-high speed camera is its hermetically sealed, large aperture, wide angle Kerr cell shutter which possesses no moving parts and is pulsed electronically.

Claimed to be the world's fastest camera, it is capable of taking photographs with an effective exposure time of five billionths of a second.

To illustrate the speed of the camera, it has been pointed out that Sputnik, moving at a speed of approximately 18,000 miles per hour, would travel only one and one-half thousandths of an inch—a distance shorter than the thickness of a human hair—during the time of one exposure.

The required camera equipment is simple, consisting of a Crown Graphic "45" camera, an electronically gated Kerr cell shutter unit, a power supply and a millimicrosecond Electronic Modulator which contains a high voltage Kerr cell pulse forming circuit and an auxiliary synchronizing pulser. The instrument operates on a standard 115 volt A.C. power source.

Among the transient self-luminous phenomena which may be studied are combustion, detonation, fuse and explosive studies, electrical discharges, arc formation, and cathode-spot phenomena. Other areas of interest are aeroballistics, hyperballistics, and magnetohydrodynamics. For non-self-luminous subjects, synchronized flash lamps can be used.

An interesting application of the camera relates to excellent photographs of three aluminum wires (0.001″ diameter by 0.25″ long) during an electrical discharge. Exposures of the wires were taken at three phases of the exploding process: (a) 20×10^{-9} second, (b) 30×10^{-9} second, and (c) 40×10^{-9} second after initiation of the discharge.

Diazotype Multicolor Kit

A novel, easy-to-use kit containing materials for making multicolor diazotype films and glossy prints from ordinary black-and-white translucent originals has been announced by Charles Bruning Co., Inc., Mount Prospect, Ill.

The kit, called Multicolor Kit No. 100, enables the fast simple production of colored motion picture and slide film titles, "static" and "dynamic" projection films, charts, diagrams and overlays.

Clear films, glossy white or aluminum prints, each containing any number of colors on a single sheet, are made by exposing a translucent original and a sheet of multicolor film or paper to any ultra-violet light source. The exposure produces a latent image on the print which is an exact duplicate of the original. The image can then be transformed (developed) into any number of colors by the application of various Bruning Multicolor developers. No darkroom, special lighting conditions, skills, or experience are required to use the kit.

The principle of the process is that the films, papers, etc. bear a thin, dry coating of a diazo compound. Diazos are light-sensitive dyestuffs which are highly sensitive to actinic light—light in the ultraviolet region of the spectrum. Exposure to this actinic light breaks down the diazo compound so that it becomes colorless, and incapable of being developed to form a dye.

When that part of the diazo coating which has not been exposed to actinic light—i.e., that part covered by opaque image lines on the original—comes in contact with the developer solution, it combines or "couples" with the developer to form a dye. Thus, each actinically opaque line of the original is faithfully reproduced on the copy. Since no vapor developer is used, the process cannot emit fumes and consequently does not require exhaust vents or ducts.

The developer solution does not require a machine, tank or other equipment since it may be applied by using a clean cotton swab, artist's brush, felt-tipped pen or other suitable medium.

Each kit contains a selection of films and papers, color developers in handy pressurized dispenser cans and developer swabs.

Electronics in Photography

Of the many significant developments taking place in the field of photography today, perhaps one of the most significant is the ever-increasing advance of electronics into fields which were formerly concerned only with mechanics, optics and chemistry.

Although electronics has been associated with photography for a long time, it is only in comparatively recent years that electronics has begun to play such a big part that it is not any longer uncommon to speak of electronic imaging, electronic amplification, etc. From this it may be deduced that the time may not be too far in the future when electronic photography will supplement, if not supplant, present conventional silver halide photograhic systems for some applications. The basis of this supposition is that the conversion of light into electrons with the subsequent transmission, amplification and conversion of these electrons into an instantaneous permanent, pictorial record requiring no chemical processing seems to possess intriguing possibilities.

As illustrations of the trend that electronics is taking in photography, it may be pertinent to review two recent patents covering devices.

The first of these, U. S. Patent No. 2,834,889, issued May 13, 1958, to Gustav Fries of Germany, covers an electronic camera. Fries' invention takes advantage of the fact that the silver halide photo-sensitive film is about 100 times more sensitive to the action of electrons than to the action of photons.

Briefly, his invention uses an image converter for transforming light rays, x-rays or infra-red rays from the image to be recorded into an electronic image which is directly focused onto a photo- or other electron-sensitive layer. Since the cathode, for example, a photo-cathode, serving for the image conversion, is expensive to produce and will become completely destroyed if it is exposed to air, it is sealed in an evacuated chamber. The chamber is provided with an electron-permeable window through which the electrons, released from the cathode and accelerated by appropriate means, can pass out of the chamber to expose a photo-sensitive or other electron-sensitive layer disposed outside the evacuated chamber.

A feature of Fries' invention is a unit incorporating an image-converter tube which can be fitted to a normal photographic camera to convert it to an electronic camera.

(*Continued on page* 33)

Independent Business

(*Continued from page* 15)

"Competitive negotiated procurement — involving the evaluation of proposals from a number of qualified producers — is a fair and effective means to obtain the best buy for the government. Every means should be taken to assure all qualified firms full and fair opportunity to make proposals and obtain equitable consideration."

The military should examine and police its procurement techniques to assure maximum competition and adequate opportunity for all qualified firms to participate.

On cost principles, the S.I.A. says:

"Since the majority of fixed price contracts involves a much higher degree of risk than cost-reimbursable contracts, it is highly inequitable to apply CPFF (cost plus fixed fee) cost allowance criteria in the settlement of terminated fixed price contracts. In a free enterprise system, profit is the recognized incentive for productivity —a legitimate objective of any business. Use of cost principals to narrow the area of profit shifts government contracting to a socialistic basis and destroys incentive. The end result is a higher net cost to government with less productivity."

Regarding government facilities, S.I.A. takes this reasonable position:

"A one-time emergency program, essential to meet the needs of World War II and Korea has been continued and expanded on a rent-free basis. 90% of these facilities are in the hands of the top 100 defense firms. Use of these facilities should be restricted, except in time of emergency —particularly when privately owned facilities are available to do the work competitively. Rentals collected for the use of government-owned facilities should be paid to the cognizant military services rather than the general fund of the Treasury—thus to serve as an offset for the cost of maintaining other equipment in reserve."

On the subject of mobilization planning, S.I.A. believes that the prospect of intercontinental warfare rules out reliance on our allies, as in the past, to furnish a holding action. Simultaneously, weapons technology has become so advanced and highly specialized as to preclude any program of conversion from commercial to military production. We must, for the first time, maintain a defense weapons industry in time of peace.

On the subject of proprietary rights, S.I.A. states that our weapons superiority can be achieved only by maximum stimulation of creativity and inventiveness. Traditional protection for patents, copyrights, trade secrets and similar property is essential to stimulate inventiveness in a free enterprise economy.

If the government must protect itself against monopoly or excessive pricing of proprietary ideas, it should do so by encouraging licensing arrangements and not by killing the incentive to invent by forcing the contractor to turn over his self-financed rights and data, pertaining to proprietary items, in return for the obtaining of a contract. This practice, which has grown through overzealous interpretation of regulations rather than any intent by Congress, should be discontinued through clearer regulations.

Even in the event where the government is clearly entitled to royalty-free use of new products or ideas, through the financing of the research and development effort, more incentive could be given the original developer if he were given more preferential treatment in benefiting from the first follow-on production. After that, he should be able to meet competition.

The S.I.A. believes that extensive competition for defense contracts is such as to eliminate now any possible justification for continuation of renegotiation. The Renegotiation Act embraces a basic error in economic principle. It restricts incentive to earn profit and hence automatically eliminates incentive to reduce cost.

While these beliefs and recommendations are not a complete list of all subjects covered in the Strategic Industries Association policy statement, they represent a major cross-section. As an independent defense contractor, I feel that the vast majority of our total business community—as well as true "free enterprise" Americans will subscribe to these policies. Acceptance by those members of Congress who are familiar with S.I.A.'s views has been widespread—among members of both parties.

In this day of many special interests, it has been refreshing to me to be associated with a group of men, many of whom are competitors, recognizing the true factors which have made this a great country. Unfortunately, the very bigness of both government and many industries has made us put a special tag on "small business," and forget that our country has been built in the tradition of independence, which spirit is most likely to be found in healthy smaller firms. Current trends must keep them healthy, if we are not to slip unconsciously into state socialism, and from there—who knows? - - - — - —

J-6 Directorate

(*Continued from page 25*)

dations with respect to existing and planned civil communications systems and facilities, to include:

(1) Allocation of such facilities.

(2) Policies and procedures for the implementation of such allocations.

- Recommend to the Joint Chiefs of Staff in coordination with other elements of the Joint Staff, the emergency allocation of existing quantities of major communications-electronics equipments.
- Plan and coordinate policy development for frequency spectrum utilization.
- Monitor the joint aspects of military frequencies allocation and the management thereof.
- Establish and coordinate promulgation of joint and combined communications-electronics operating procedures and instructions.
- Develop and coordinate promulgation of joint and combined principles and procedures for the compatibility and standardization of communications-electronics systems and equipment. Where operational compatibility is involved, establish the operational characteristics of the systems or equipment.
- Review and recommend to appropriate agencies adoption of joint operational characteristics for communications-electronics systems and equipments.
- Provide and/or arrange with Military departments for representation and membership as appropriate, on U. S. and international communications and electronics bodies affecting the Military Forces of the United States and furnish appropriate guidance to such representation.

The Director for Communications-Electronics shall have the authority to furnish joint views to appropriate governmental departments and agencies in the area of military communications and electronics on matters which do not require approval by the Joint Chiefs of Staff and which are within the frame of established Joint Chiefs of Staff policy.

The Director for Communications-Electronics is authorized to refer such matters as he deems appropriate to the Military Communications-Electronics Board for detailed preparation and coordination and is responsible for the necessary follow-through and final review on such matters.

A Trip to Mars

(*Continued from page 24*)

extreme velocities, when the ship was not accelerating, occupants would not feel motion anymore than you and I feel the existence of our common motion of orbiting about the sun or our speeding as a part of the solar system through space itself. During the space journey acceleration would be small but over long periods of time.

Upon arriving at Mars some 260 days later, an adaptation maneuver would put all ships into an orbit about Mars. Three ships would descend to Mars for about 400 days of exploration. Two would return to the Mars' orbit taking all personnel. Finally seven ships would return to the earth's orbit.

Though not too much is known about Mars, the astronomers and physicists do tell us something about it. Some of this is shown in Figure 5. The presence of some atmosphere, the daily cycle of 24 hours, 37 minutes, and the 24° tilt of its axis to cause seasonal climate all give some hope of life on Mars. Bluish green patches are observed to have some variation with the seasons, as do the ice caps in its polar regions. The type of habitation would probably be quite different from ours. However, on our globe, life seems to adapt itself to its environment in all types of situations from the oceans' depth, to the arid desert; from the mountain tops, to the polar regions.

Why go? The answer is no clearer than why the West was explored, conquered and finally made a part of our country. Our search for newer and better ways of life has carried us from the cave man era. Why stop now? We must progress. There is no such thing as marking time for long. We must either move ahead or be eclipsed by those who do. Maybe there is a fountain of youth on Mars or Venus!

MARS

½ Size of Earth
141,000,000 Miles From Sun, Mean Distance
(Earth is 94,000,000 Miles From The Sun)
35,000,000 Miles From Earth At Nearest Point
Weight on Mars 38 Percent of that on Earth
Atmospheric Pressure. 0.1 of that on Earth
Water boils at 110°F
Mean Yearly Temperature 50°F
Length of Year 687 Days
Length of Day 24 hours 37 minutes
Axis Inclined 24° to Produce Seasonal Climate

(Figure 5)

Photoprogress

(*Continued from page 29*)

Advances in Color Printing Techniques

A new automatic computer that takes full advantage of the capacity of Kodak Type C color print material to produce color prints of superb quality, equal to those obtainable with the dye transfer method and at a fraction of the cost, has been developed by Simmon Bros., Inc., 30-28 Starr Avenue, Long Island City 1, N. Y.

Called the Simmon Omega Tricolor Computer, it incorporates a system for low cost testing and offers a color preview of the finished print. With this guide for color correction, the computer is set and automatically provides correct exposures, compensating for the color balance and sensitivity of the paper, the color balance and density of the negative, the color temperature of the light or the type of filter with which the picture was taken, the size of the negative, and the desired print size.

The computer automatically coordinates all these related factors, computes the exposure relationships and applies the correct exposure through three filters. It automatically compensates for failure of the reciprocity law and eliminates the color drift that otherwise occurs when the magnification ratio is changed.

The comparator provides a range of 28 color correction settings. It is primarily an instrument to simplify custom printing procedures and can be readily understood and operated by any color laboratory technician familiar with Type C color processing. Price of the computer, complete, will be about $2,000.00. (Fits Simmon Bros. Omega D-2, and Automega D-3 and E-5 Projection Printers and adapts to some other makes.)

Bodensee Model Kth 57 Cine Theodolite

The Perkin-Elmer Corp., Norwalk, Conn., well-known for its work on long range optical tracking instruments, and Bodenseewerk Perkin-Elmer & Co., G.m.b.H., Ueberlingen, West Germany, have formed a team with unique facilities for the development, production, installation and servicing of optical tracking devices.

Bodenseewerk's most recent cine theodolite, the Model Kth 57, will be distributed and serviced in this country by Perkin-Elmer. Model Kth 57 Cine Theodolite embodies increased accuracy, range and dependability together with improved adaptation facilities. These features have been obtained by an increased precision in manufacture, the use of proven electronic accessories, the availability of a series of interchangeable long focus lenses and the development of control and monitoring devices.

The camera mechanism is electrically driven and permits a maximum frame rate of 5 exposures per second. It is provided for use with double perforated 35mm standard film (picture size 29 x 36mm).

Exposure time of the solenoid-operated shutter is 1/150 second. A frame counter (0-999), a film counter (99.9 meters), and a heating system for winter use are provided. The camera cassettes (separate feed and take-up cassette, both of identical design) have a film capacity of 1000 frames maximum. The delay time from trigger pulse arrival to completely opened position of shutter is kept constant by special mechanical and electronic devices with an accuracy of 1 msec. The synchronism of cine theodolites attached to one station is therefore improved by approximately the factor 10 as compared with former instruments. The camera is fitted with a filter turret which accommodates—apart from clear glass—3 filters according to requirements (also polarizing filter, if desired).

The following three interchangeable lenses are available for use with the camera: 300mm f/3.5, telephoto 600mm f/4.5 and catadioptric type 1000mm f/7.1.

The following catadioptric lenses can also be used with the camera; however, they are not interchangeable with the above lenses without prior modification of the camera: 48" f/7.1; 60" f/7.1 and 100" f/11.

The azimuth and elevation circles are graduated in degrees or centesimal degrees, according to requirements (accuracy 2 seconds of arc).

Automation in the Photographic Film Data and Pictorial Recording Fields

Automation has inevitably invaded the photographic film data and pictorial recording fields through the use of automatic machines and devices subject to the control of electronic instruments. Evidence of this is the recent development of two machines which employ automation in the performance of functions that were formerly done manually or with a minimum of automatic devices. The first of these machines is called FLIP (Film Library Instantaneous Film Presentation), a development of the Benson-Lehner Corp., 11930 West Olympic Blvd., Los Angeles 64, Calif.

Briefly, FLIP is an automatic microfilm searching machine designed and built for information retrieval of large masses of documents.

The prime design criterion in the case of FLIP was to develop a machine that would search for a particular frame on 16mm film at the comparatively high speed of 300 to 600 frames per second and then present this frame to the operator for viewing. Each frame contains pictorial data and binary coded inormation. The binary coded bits are in the form of black bars on a clear background; 32 bits in this case provide all the necessary combinations desired.

In this particular application the machine searches for a particular binary number without knowing its exact location on the film. Knowing only that in one direction numbers are always increasing although there may be large gaps in the sequence, the machine chooses the correct direction for search and upon recognizing the frame, stops, overshoots about five frames and returns to project the image on the screen for visual presentation.

The film transport is designed to accommodate 1,200 feet of 16mm, double perforated film containing up to 72,000 frames. The film is scanned at a minimum speed of 60 in/sec. and using 16mm film, the machine can handle the equivalent of 1,080,000 documents per hour. The image is enlarged approximately 50 times on the rear of a backlighted screen without appreciable loss of resolution or contrast. The resolution of the optical system is stated to be better than 25 lines/mm. The machine is a completely self-contained equipment and no additional components or accessories are required.

The company states that with proper engineering and design a machine for 35 or 70mm film can be built, and that a reproduction process for producing copies can be added.

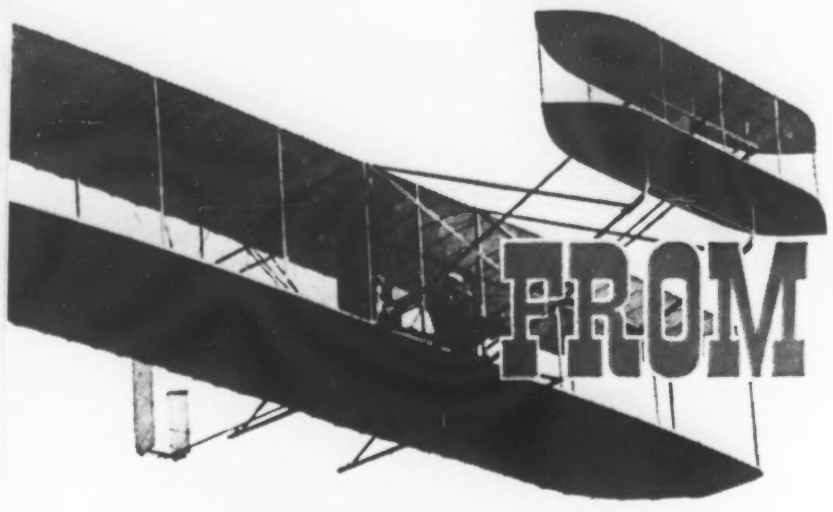
The second machine, which is in a slightly different category but utilizes automation, is a Digital and Pictorial Electronic Recorder reported by R. G. McPherson and I. A. Sonderby of the Magnavox Research Laboratories, Los Angeles, Calif., in the May 1958 issue of *Communications and Electronics*.

The machine is a film data-recording system which combines the advantages of pictorial and digital recording. The digital code record is recorded on an adjacent film frame and provides a record of instrumentation, time or other identifying information.

For readout, several methods were investigated—optical-mechanical, cathode ray tube and storage tube. The Vidicon storage tube was chosen as the most practical. In the system using this tube the information matrix is projected on the photoconductive layer on the face of the Vidicon. This layer is then scanned from within the tube, and signals corresponding to the light areas in the information array are presented at the output. The signals are then amplified and are available for use in the decoding or sensing equipment.

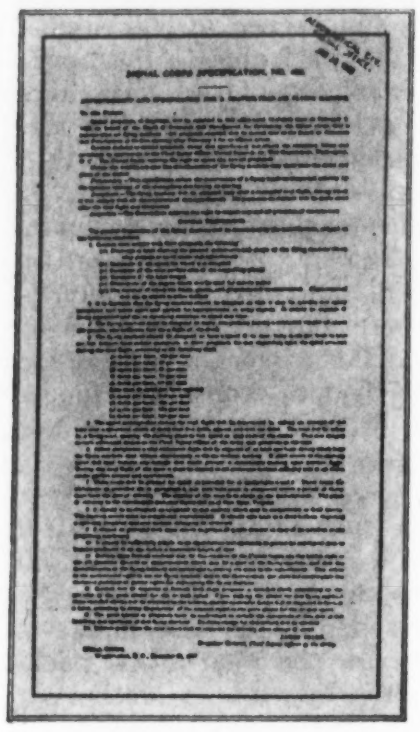
The authors state that the advantages of film recording include high density recording (6000 bits per inch), high readout rates (200 kc bit rate), and high data storage per cubic foot. Experimental recording work has been reported on systems approaching 10^6 bits per sq. inch and readout rates as high as 2-megacycles.

With the use of the techniques developed for existing machines, preliminary studies indicate that search of 40 frames per second of data made up of 600 bits per frame may be achieved.



FROM THE WRIGHT FLYER T

50 Years of U.S. Army Sign



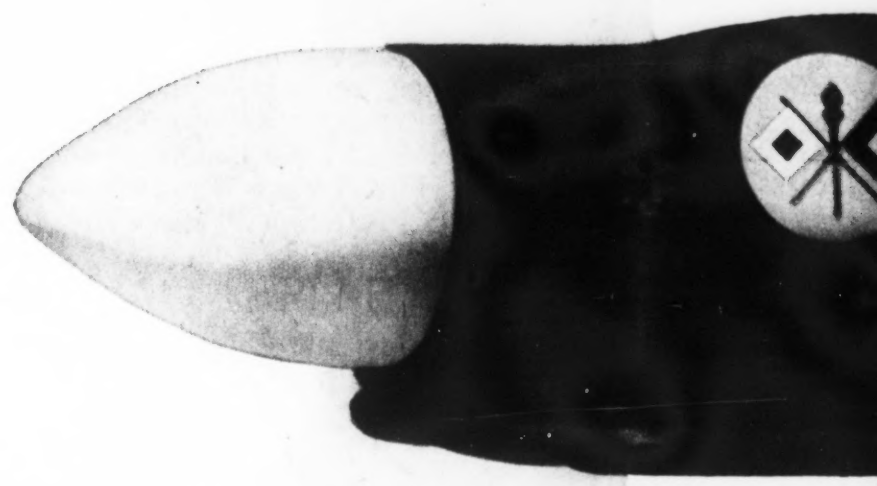
On December 23, 1907, Brigadier General James Allen signed Army Signal Corps Specification No. 486 and made history. It was the first specification by the U.S. Government for "a heavier-than-air flying machine with no gas bag." On February 8, 1908, the Army Signal Corps accepted Wilbur and Orville Wright's bid to provide a machine to meet this "fantastic specification," as it was heralded in the press of that day.

Provisions of the specification included: "2. It is desirable that the flying machine should be designed so that it may be quickly and easily assembled and taken apart and packed for transportation in army wagons...4. The flying machine should be designed to have speed of at least forty miles per hour in still air...8. The starting device must be simple and transportable. It should also land in a field without requiring a specially prepared spot and without damaging its structure... 10. It should be sufficiently simple in its construction and operation to permit an intelligent man to become proficient in its use within a reasonable length of time..."

It was intended that the Wright Flyer be used for military surveillance, but, although it had to meet tough Army standards of reliability, its performance was seriously limited. Carrying a pilot and observer, the old flyer could only be expected to labor dangerously over enemy positions in broad daylight.

TODAY COMBAT SURVEILLANCE DEMANDS DRAMATIC NEW PERFORMANCE WITH NO LESSENING OF RELIABILITY

Now, 50 years later, the Defense and Technical Products Division of Rheem Manufacturing Company has developed the SD-2 Drone to meet the very latest Army Signal Corps specification for a surveillance aircraft. The new Rheem SD-2 is an unmanned, high-performance drone that darts in and out over hostile positions, night or day in all kinds of weather, providing battlefield commanders with an up-to-the-minute picture of enemy activities. Flying ten times faster and a hundred times higher than the early Wright



Flyer, the pilotless SD-2 substitutes electronics and photogrammetry for pilot and observer...but still must face up to the same rugged Army requirements for *field reliability.*

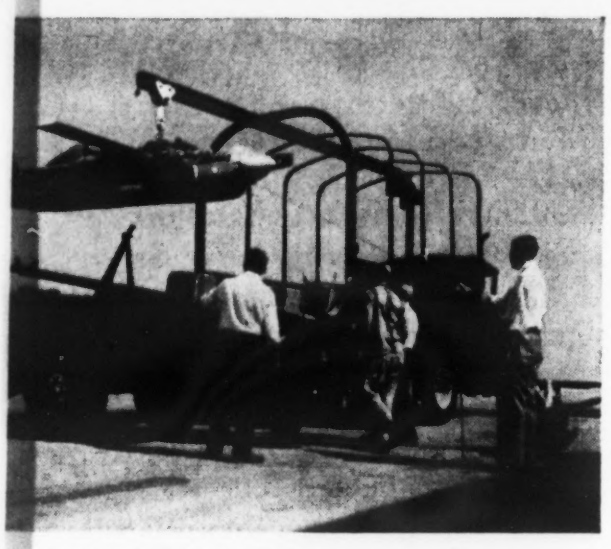
Like the Wright Flyer, the Rheem SD-2 can "be quickly and easily assembled and taken apart and packed for transportation..." (In Army trucks, trains, or Flying Boxcars.) "The starting device" is "simple and transportable." In the field, a standard M-211 truck transports four fully assembled SD-2's, and a zero-length launcher on an M-105A1 trailer provides the completely portable launching device. And, for "landing in a field without requiring a specially prepared spot and without damaging its structure," the SD-2 is provided with a reliable parachute recovery system.

Proving its ability to meet the Army's age-old standard of "simplicity in construction and operation," the Rheem SD-2 is presently being put through its paces at the Army Electronics Proving Ground, Fort Huachuca, Arizona. After passing rigorous Army flight tests, the SD-2 will take its place in the field as another reliable combat system contributing to the superiority of U.S. ground forces everywhere.

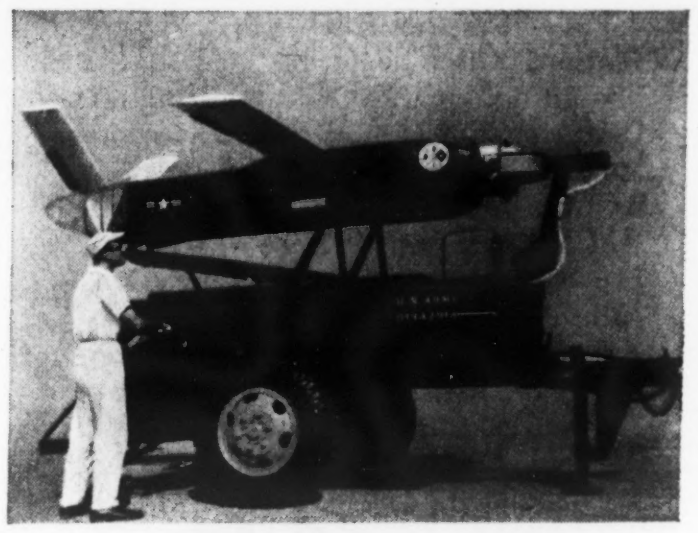
If you would like to have a 7" x 12" reproduction of "Signal Corps Specification, No. 486" suitable for framing, write Dept. S-407-1.

R TO HE RHEEM SD-2 SURVEILLANCE DRONE

Signal Corps Progress in Combat Surveillance



Standard M-211 truck transports four fully assembled SD-2's.



A zero-length launcher on standard M-105A1 trailer provides completely portable launching device.

A simple starter mounted on trailer starts drone engine prior to Jato take-off.

RHEEM MANUFACTURING COMPANY

Defense and Technical Products Division

11711 woodruff avenue, downey, california

Rheem

Association affairs

AFCEA

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Washington 6, D. C.
Phone: EXecutive 3-3033

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**Executive Committee Member.*

Associate Editor Honored

Edward K. Kaprelian, Associate Editor of SIGNAL, was made a Fellow of the Society of Photographic Scientists & Engineers at their Annual Technical Conference held in Rochester, New York.

Mr. Kaprelian, who joined the Editorial Staff of SIGNAL in June 1958 as Associate Editor, is Assistant Director of Research, U. S. Army Signal Research & Development Laboratory, Fort Monmouth, New Jersey.

William F. Hogan Associates, Inc.

The William F. Hogan Associates, Inc. has joined the AFCEA group membership. This communications consultant company is located at 2 Overhill Road, Scarsdale, New York.

The company representatives in AFCEA will be: W. F. Hogan, President; T. T. Tucker, Executive Consultant; N. McCaffrey, Sales Representative and J. W. Kitchen, Consultant.

Convention Chairmen Discuss 1959 Plans

Plans for the 1959 AFCEA Convention, which is to be held at the Sheraton-Park Hotel, Washington, D. C., June 3, 4 and 5, were formulated by committee chairmen at their first meeting. Captain W. B. Goulett, AFCEA Executive Vice President, presided at the meeting which was called to discuss the numerous problems involved in planning the convention.

Held recently in the office of Mr. Millard C. Richmond, the meeting was attended by: Col. Percy G. Black, USA (Ret.), Automatic Electric Company; Mr. Murray Block, Federal Telephone & Radio Co.; Mr. Ed Dyke, Page Communications Engineers, Inc.; Mr. John F. Gilbarte, Admiral Corporation, and Mr. Thomas E. Gootée, Office of Technical Liaison, Office of the Chief Signal Officer.

Other chairmen present were: Mr. G. L. McGowen, Texas Instruments Incorporated; Mr. W. D. Meyers, Cook Electric Company; Mr. J. F. Whitehead, Nems-Clarke, Inc., and Mr. F. W. McDermott, Federal Telephone & Radio Co.

Those named as Chairmen but unable to attend were: Mr. Francis H. Engel, Radio Corporation of America; Mr. Thomas B. Jacocks, General Electric Company; Mr. Frank Martins, AFCEA; Mr. John O'Brien, Hoffman Laboratories, Inc.; Mr. Millard C. Richmond, Western Electric Company; Vice Admiral Murrey Royar, USN (Ret.); Colonel W. J. Baird, Editor, SIGNAL, and Mr. William C. Copp, William C. Copp & Associates.

Chicago Chapter Gives Awards to Reservists

Sergeant First Class Donald L. Weernink, a member of the Illinois National Guard's 33d Signal Company (33d Infantry Division), received a Certificate of Achievement recently from the Chicago Chapter of AFCEA. The President of the Chicago Chapter, Mr. Henry J. MacDonald, made the presentation. Col. Albert J. Mandelbaum, Fifth U. S. Army Signal Officer, read the citation which accompanied the Certificate of Achievement.

Two other Illinois citizen soldiers who are to receive the Achievement award are Sergeant First Class Hugh G. Brooks, 805th Signal Company, Bryn Mawr, and Master Sergeant Arthur C. Zornes, 85th Signal Company (85th Infantry Division), Peoria.

The certificate was awarded to Sergeant Weernink "in recognition of his outstanding performance of duty as a member of a unit of the Reserve Components of the Army of the United States and in recognition, in particular, of his outstanding accomplishments and demonstrated proficiency in the field of communications and signal activities."

To be eligible for nomination, a reservist must meet the following prerequisites: be qualified in his military occupation specialty, attend 95 per cent of scheduled drills during the year, participate with his unit in the two weeks of annual active duty for training at summer camp, qualify as a "sharp shooter" or higher with his assigned weapon and have had no disciplinary action under the Uniform Code of Military Justice.

Coming: Special March Component Issue

NEW AFCEA MEMBERS

With this issue, we are inaugurating the policy of listing monthly new members who have joined the Association and the Chapters with which they are affiliated. The following list represents new members admitted during the month of November 1958. The December listings will appear in February.

ARIZONA
Anson B. Clinton
Lt. Col. Hanford T. Colwell
Maj. Laurence L. Dantzer
1st Lt. Frank F. Dorey
2nd Lt. Frederick J. Duffy
Maj. Karl E. Gorwoda
Robert B. Hitchcock
Lynnon J. Knight
Keith D. Morrow
Capt. Eugene C. Paulson
Paul L. Richardson
G. Gene Thomas
Capt. James D. Tyson
Lt. William B. Worthington

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William E. Kilpatrick
Alex H. Kizer, Jr.
Arthur E. Sharp, Jr.
Fred C. Siler

BALTIMORE
Comdr. Bob Kirsten

BOSTON
Lt. Comdr. Kendrick H. Lippitt
J. B. Meagher
Harold A. Potsdam
Gene H. Weiner

CHICAGO
Capt. John P. Anderson
Jack E. Banister
John W. Benekos
George B. Chapman
Anthony N. Genovese
A. W. Haarlow
Maj. Harry A. Karch
Dr. Ernest A. Keller
Frederick C. Matthiesen
George C. O'Brien
Lt. Col. Louis M. Olszyk
R. F. Onsrud
Joseph Pabian
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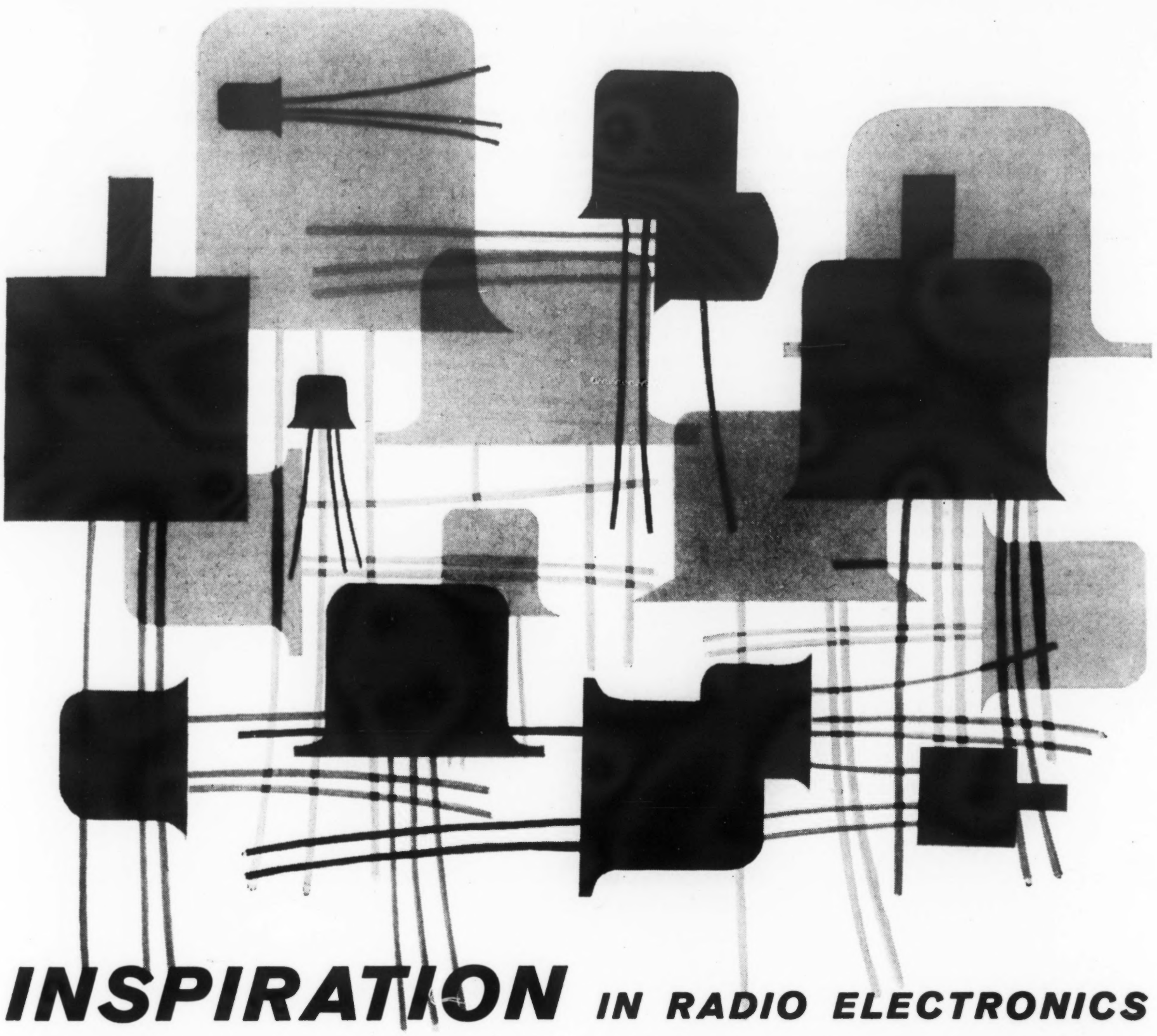

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Chapter News

Arizona

The chapter opened its 1958-59 series of meetings with a "fall round-up" at the Officer's Club on November 4th. Many "hands" turned out and the Western attire reminded the "old timers" of Cochise County before the days of the Electronic Proving Ground.

The highlight of the evening's program was an address by Dr. William Welsh, Director of Research, Military Electronics Division, Motorola, Inc. Dr. Welsh's talk illustrated the application of many basic theories of physics to modern electronic devices used by the military services. He stated that reductions in the size of electronic components by a factor of from 100 to 500 were termed feasible within the next ten years and added that the new approaches to solid-state electronics will require extremely precise control of material composition—ceramics and semiconductor metals, for example—as well as mechanical control of thin films and manipulation of microscopic parts in assembly.

Lt. Col. W. C. Golladay, chapter president, announced he had received orders to report to a new duty station. The chapter gave him a vote of appreciation for his leadership and for the outstanding program of activities scheduled for the year.

The chapter wishes to advise representatives of private corporations who visit the U. S. Army Electronic Proving Grounds at Fort Huachuca that rental cars are available at the Sierra Vista Airport, which is the nearest commercial airport to Fort Huachuca. Advance reservations for cars at the Sierra Vista Airport may be made at any Apache Airlines ticket office.

Augusta-Fort Gordon

Col. Robert R. Creighton, Assistant Commandant of the Southeastern Signal School, was elected president of the chapter at its November 20th meeting.

The other officers chosen during the annual election were: first vice president—L. C. Phillips; second vice president—Otto Lechman, RCA; third vice president—William N. Drake, American Telephone & Telegraph Co.; treasurer—E. L. Lynch, Southern Bell Telephone & Telegraph Co.; secretary—Lt. Col. Ollie J. Allen, USASTC; directors—J. C. Woodward, Southern Bell; G. W. Sims, Southern Bell; Lt. Col. Fred J. Frank, Hq. & Hq. Det. USASTC, former advisor to AFCEA's Northeastern University Student Chapter; Lt. Gasper Blandeburgo, Hqs. SUTG; Jack R. Young, Southern Bell; M/Sgt. Martin L. Jenkins, TSESS; Col. Charles A. Wingo, Hqs. USASTR, and Francis A. Saxon, Georgia Power Co.; National Council representatives—Brig. Gen. David P. Gibbs, USASTC, and L. C. Phillips.

Col. Erling J. Foss, USASTC, served as chairman of the nominating committee.

Featured as guest speaker of the evening was Capt. Etienne Sicard who gave a talk on "The New French Constitution."

Boston

Senior commanders in the New England area were guests of the chapter at the November meeting held in the Commander's Conference Room, Boston Naval Shipyard.

Speaking to Boston members on the principal activities conducted by the various Armed Forces throughout New England were: Maj. Gen. Sidney C. Wooten, Commanding General, XIII U. S. Army Corps (Reserve), and Fort Devans; Capt. Edson H. Whitehurst, USN, Chief of Staff, First Naval District; Rear Adm. Edwin J. Roland, Commander, First Coast Guard District, and Col. Joe G. Gillespie, USAF, Commander, 6520th Test Group (Support), (Air Research and Development Command), Air Force Cambridge Research Center.

Also present was AFCEA Regional Vice President Glenn D. Montgomery, who is Defense Coordinator for Long Lines, American Telephone and Telegraph Company. Mr. Montgomery gave the members a brief report on AFCEA affairs.

Chicago

The Teletype Corporation was host to the chapter on October 30th at its Touhy III plant. The dinner-meeting set a new all-time attendance record for the chapter. Space limitations held attendance to 405.

The new 100-word per minute automatic switching system for the communications network of the United States Air Force was the topic of discussion.

Edward J. Agnew, Automation Applications Engineer of the Western Union Telegraph Company, was the principal speaker. He is in charge of the circuit and cabinet design of the switching system—generally referred to as "Plan 55"—which was engineered to meet the requirements of the Air Force.

W. J. Zenner, Vice President, Research and Development, W. H. Pagenkopf, Vice President, Manufacture, and D. R. Carmichael, Vice President, Sales and Finance, represented Teletype Corporation.

A display of some of the components of Plan 55 was set up outside the plant cafeteria, together with operating display of Teletype equipment, so that visitors could see the equipment in actual operation. Included in the display was equipment manufactured and supplied by the C. P. Clare Company and the Seeburg Company. A tour of the factory concluded the evening's activities.

Mr. Agnew said that by the end of 1959, Plan 55 will provide ten fully automatic relay centers, features of which will include (a) rapid automatic operation, (b) provision for manual switching of defective messages, (c) compatibility with other military communications systems, (d) handling of multiple address messages, (e) use of the building block principle permitting quick installation and removal of components and (f) handling of high precedence traffic.

Honor guests for the occasion were: Maj. Gen. D. C. Doubleday, Commander of the AACS, Scott AFB, and staff consisting of Col. H. L. Hughes, Col. G. A. Zahn, Lt. Col. A. C. Wheatley, Maj. D. A. Dunn, Lt. J. G. Valley

Chicago—Chapter meetings have been drawing record turnouts this fall. Shown above is a portion of the crowd attending the meeting at the Cook Electric Company's Technological Center on November 20th.

Hawaii—The October meeting featured a tour of the Commander Early Warning Barrier Pacific. Left to right are: Col. J. H. Weiner, Pacific AF Hqs, Hickam; Louis Robello, Plant Supt., Hawaiian Telephone Co.; Col. O. C. Buser, U. S. Army Pacific Hqs; Capt. J. F. Dalton (partially shown), CO, U. S. Naval Communication Station, Pearl Harbor, and chapter president; Capt. J. B. Burks, Chief of Staff, Barrier Pacific Hqs; Col. S. A. Mundell, USAF, Commander in Chief Pacific Hqs, and Cdr. J. F. Cable, Barrier Pacific Communications Officer.

and Lt. Harry Ohls, and Allan L. Eisenmayer, secretary of the Scott-St. Louis Chapter.

The Cook Technological Center in Morton Grove was the scene of the chapter's November 20th gathering. Walter C. Hasselhorn, President of Cook Electric Company, was host on behalf of his company.

Dr. H. V. Hawkins, Assistant Director and Head of Aero-Dynamics Section, Cook Technological Center, first presented the Cook-produced film "First from Space," which depicts missile nose cone recovery systems designed by Cook Research Laboratories. He then delivered a talk entitled "Flight to Mars." (For the benefit of SIGNAL readers, Dr. Hawkins' entire speech appears on page 22 of this issue.)

Special guests of the chapter were: Brig. Gen. Charles E. Jung, Deputy Commander, Air Materiel Area, Oklahoma City, an element of the Air Materiel Command, Tinker Air Force Base, and Col. H. J. Almond, Controller of the Air Materiel Area.

Dinner was served to 380 members and guests in temporary facilities established in the area occupied by Cook's new twin jet (J-47's) powered wind tunnel. This tunnel is capable of producing air speeds up to Mach 3. The wind tunnel was brought up to speed while the guests were seated at the tables. It was undoubtedly the first time that a group of this size had witnessed and listened to the operation of a wind tunnel of this capacity and velocity.

A tour of the plant was conducted at the end of the program and included a visit to the cobalt-60 radiation source (world's largest), environmental testing laboratories, IBM 650 computer applied to research problems and other exhibits.

Decatur

Maj. Joseph J. Rein, Chief of the Decatur Depot Maintenance Division, was guest speaker at the October 28th meeting. His presentation consisted of a lecture, illustrated with color slides, on the country of Cambodia.

This meeting took place at the Officer's Mess of the Decatur Signal Depot.

Fort Monmouth

Former Governor George N. Craig of Indiana, speaking before the chapter's November 19th meeting, advocated serious research and development, such as in American science, in other government agencies, education, public health and other vital agencies.

Before a large audience of members and guests at the dinner-meeting held at Gibbs Hall Officer's Club, Mr. Craig, now a prominent Washington lawyer, praised the country's military organization in the selection of its leaders, but said that the same could not be attributed to other top-flight branches of government.

Among examples, he referred to selections for key posts in the diplomatic corps and touched on lagging research and development in the fields of education, civilian defense, public health and called for a change of procedures.

"We must progress, design, devise," he said, "if we are to succeed."

The former Indiana Governor was introduced by Col. A. L. Burke of the Army Signal School, chapter president. They had served together in World War II in the European Theater.

Gulf Coast

The program of the chapter's November 4th meeting was presented by Wallace R. Bunn, District Manager, Southern Bell Tel. & Tel. Co., Hattiesburg, Miss. His subject was "The American Way of Life."

Among the members present at the meeting were the following former members of the Scott-St. Louis Chapter who recently had been transferred to Keesler Air Force Base: Prosper L. Kinsella; Col. Wilbur C. Strand; Howard Yund, and Walter W. Van Skiver, who had been the 1956-57 president of the Scott-St. Louis Chapter.

Hawaii

The October meeting of the chapter was held at the Commissioned Officer's Mess at the U. S. Naval Base Pearl Harbor and was followed by a tour of the headquarters installation of Commander Early Warning Barrier Pacific at the nearby Barber's Point Naval Air Station.

At the Barrier Headquarters, Capt. J. B. Burks, Chief of Staff, explained the strategic background of the national early warning system, described the part played by the seaward extension of the system in the Pacific area and detailed the concept of operations and the communications systems used to control the ships and planes in the Pacific Barrier. Captain Burks noted the importance of this military operation to the Territory and the impact of the establishment of a new, large command on the local economy.

Following Captain Burks' discussion, the members were escorted to the plotting facilities, where a description of the methods of plotting surface and air contacts was given by Capt. J. P. Robinson, Jr., Operations Officer. He also described the weather problems associated with the operation and the methods of evaluating information. Commander J. F. Cable, Commander Barrier Pacific Communication Officer, escorted the group through the communications installation explaining the methods of operation and the types of equipment in use.

The tour evoked a great deal of interest among the members attending because of the close association of the operation with the general military activity of the Territory. The meeting was attended by an exceptionally good turnout.

The chapter plans a winter and spring program which will include tours of industries in the Territory and trips to other military communications installations.

Kansas City

Richard White, Manager, Electronics Engineering, Trans World Airlines, gave a lecture on TWA's Electronic Flight Simulator Training at the November 20th meeting. Following the dinner-meeting at the President Hotel, the group was taken on a tour of the simulator facilities and integral electronics computers at TWA.

Mr. White briefly summarized some of the history of the simulators prior to showing slides, which were similar to those studied by the student flight crew members. The majority of the

illustrations were formulas and mathematical computations used in actual flight and their relation to the flight simulators.

Following the slide presentation and discussion, the group went to the TWA Flight Operations Training Center, where a flight simulator was on display. The mechanism of a simulator is even more intricate than that of an airborne plane because, in addition to all of the instruments to be found in a plane, it is necessary that a simulator also have equipment to create any difficulty which a pilot might conceivably encounter in actual flight. Such difficulties could include engine trouble, circuit failure, fire, unusual weather conditions, loss of altitude, etc. Through such man-created hazards, a pilot can plan what he would do in the event of a real emergency and, by this pre-planning, could avert a possible catastrophe to himself and his passengers.

The simulators are used in refresher courses for trained pilots, as well as for pilot trainees. Since no weather hazards are involved, the simulators can be operated at all times without risk to crew or equipment. Also, the simulators can be operated for $125.00 per hour, while it costs from $300.00 to $400.00 an hour to operate aircraft used for training purposes.

During the business session, Chapter President Lee Eastmond launched a membership drive. He introduced the new membership chairman, William J. London of Southwestern Bell Telephone Co., who emphasized the importance of recruiting new members and urged every member to take an active part in the campaign.

London

The chapter held its semi-annual ladies night on October 16th. As a result of the great success of the previous ladies night, it had been decided by the Executive Committee to make the affair a semi-annual one instead of annual.

The dinner-dance was held in the Crystal Ballroom of the Columbia Club and the evening's activities began with a cocktail reception. An excellent five-course dinner was served and was followed by a cabaret act currently appearing in London.

Montgomery

On October 28th, the AFCEA chapter and the Montgomery Sub-Section of the American Institute of Electrical Engineers held a joint meeting at Maxwell Air Force Base. Dr. Cyril N. Hoyler, Manager of Technical Relations for RCA Laboratories, presented the program "New Adventures in Electronics."

A buffet supper at the Officers Club, attended by 150 persons, preceded the program. Lt. Col. Herbert Herman, president of the Montgomery Area Chapter, and C. S. Weiss, chairman of the Montgomery Sub-Section of AIEE, greeted the many distinguished guests. These included: Mayor W. A. Gayle of the city of Montgomery; L. R. Grimes of the Montgomery County Board of Revenue; Major General James F. Berry, Adjutant General for the State of Alabama; Frank Newton, Vice President and General Manager of Southern Bell Telephone and Telegraph Co., Birmingham; E. A. Wilson, Manager, Power Sales Department, Alabama Power Company, Birmingham, and B. B. Marsh, Vice President, Southern Division, Alabama Power Company, Montgomery.

Some nine hundred persons attended the program in the auditorium at the Air University. Mr. Hoyler was introduced by Col. Paul T. Hanley, Vice Commandant of the Air War College, after a welcoming address by Lt. Col. Herman.

The Montgomery Dispatch had this to say about the program:

"A gray-haired scientist with a keen sense of humor converted a maze of scientific terminology into an interesting hour and 45 minute lecture on space electronics here Tuesday night.

"Dr. C. N. Hoyler of RCA Laboratories, Princeton, N. J., covered the field of electronics from picture transmission to manufactured musical sounds with a deftness attributed only to those with years of study and experience behind them.

"With 1,500 pounds of electronics equipment to demonstrate his lecture, Dr. Hoyler spent the better part of his lecture period on the fringe of 'deep science' and turned a crowd of military and civilian listeners away feeling he had made them a part of a world they knew little or nothing about.

"Perhaps the most interesting portion of the lecture was a demonstration of manufactured music.

"Dr. Hoyler explained that with only electronic impulse and a magnetic tape, science now is able to 'manufacture' sounds which imitate any musical instrument, or duplicate any tone known to man.

"Demonstrations of the 'manufactured' music ranged from the golden tone o the harpiscord, to harmonious renditions of mixed instruments.

" 'Such music may some day be used in movie productions where musical or tone perfection is desired,' he explained after the lecture.

"Dr. Hoyler, manager of technical relations for RCA, also demonstrated tiny electronic television cameras and radio transmitters—a part of what he called a 'miniaturization of instruments as we know them today.'

"The television camera, which not only captured the picture but transmitted it to a standard television set nearby, was no larger than a small cigar box.

"A walkie-talkie, which now is replacing a box about two feet long by six inches square used during World War II and the Korean conflict, is no larger than a cigarette case. Used by the man in the field, it can transmit voice 500 to 800 yards.

"He also displayed a 'wristwatch' radio transmitter which he said 'has the comic strip writers worried, because they don't know what to write about now. We've caught up with them.' "

Another joint meeting of the local AFCEA and AIEE units on November 18th featured a lecture-demonstration entitled "Picture It in Color" by Frank Pallo of the Eastman Kodak Company, Rochester, New York.

"Picture It in Color," illustrated with Kodachrome and Kodak Ektachrome transparencies shot in many sections of the United States, is a study of the basic fundamentals of picture taking. Ater outlining examples of outdoor, flash, flood and existing light conditions, Mr. Pallo illustrated one of the most important things a picture can do—that is, to tell a story. To show how all of these aspects could be put to use, the audience was taken on a delightful photographic holiday, where they saw his exciting action shots and story sequences and learned how easy it was to create some pleasing patterns with light.

New York—"Communications for Defense" was the subject of the October 29th meeting. Grouped in front of the Bell System exhibit are, left to right: Col. Bruce C. Downs, USAF; Glenn D. Montgomery, Defense Coordinator for the AT&T Long Lines Department, who was the principal speaker; Chapter President Ludwig R. Engler of RCA Communications, and Col. William E. Jennings, Signal Officer, First Army.

New York

At its monthly meeting at the Belmont Plaza Hotel on October 29th, the chapter had the pleasure of hearing

from one of its own members who is well known in AFCEA circles and long an active worker for the Association—Glenn D. Montgomery, Defense Coordinator for the A.T.&T. Long Lines Department, and AFCEA Regional Vice President. His subject was "Communications For Defense" in which he demonstrated how important the considerations of national defense have become in planning and engineering a modern communications system.

In his illustrated talk, Mr. Montgomery described our domestic and world-wide communications and showed how they have grown and changed since World War I. He cited some of the major projects which have been undertaken by the Bell System in recent years and showed how these were related to our defense requirements. The transatlantic telephone cable, for instance, was made possible by technical developments in voice transmission and now provides the military, as well as the public, with a more dependable service to Europe. Likewise, the Alaskan cable system, which was constructed in cooperation with the Alaskan Communications System, a branch of the Army Signal Corps, provides important communications for the DEW Line and the White Alice System, our frontiers of defense. In the United States, the Bell System has provided a system of alternate routes so as to by-pass target areas and maintain essential service even though some part of the telephone system is destroyed. Mr. Montgomery emphasized the importance of engineering the telephone plant for maximum protection against damage of all kinds because of the complex military communications networks which would be so vital for directing defense activities in case of attack.

Mr. Montgomery closed by stating that the telephone industry recognizes its responsibilities for planning to meet fully all of our country's communications needs—now and in the future.

North Carolina

A Southern Bell program on the subject of radar defense and the Vanguard satellite was presented at the chapter's October 29th meeting. R. E. Wood, Southern Bell representative, conducted the program.

Thornton W. Rose of Carolina Tel. & Tel. Co., program chairman, introduced the program.

The dinner-meeting was held in the John R. Hodge Room of the Fort Bragg Officers Mess, with sixty-three members present.

North Texas

On October 24th, W. L. Doxey, Deputy Director, Electronic Components Research Department, U. S. Army Signal Research and Development Laboratory, Fort Monmouth, addressed a joint dinner-meeting of the AFCEA chapter and the local section of the IRE at the Naval Air Station.

With "A Trip Through the Iron Curtain" as his subject, Mr. Doxey, who recently toured Russia, gave an authentic report on the electronic capabilities of the USSR. He also illustrated his discussion of new developments with color slides and firsthand knowledge of Russian activities in the electronic field. At the conclusion of his program, Mr. Doxey answered many questions from the audience.

During the evening, Mr. Doxey was presented with a ten-gallon Texas hat, an Honorary Texas Citizenship Certificate signed by Governor Price Daniels and an Honorary Deputy Sheriff's badge and commission from Sheriff Bill Decker of Dallas County.

Northeastern

The 93rd Transportation Company (light Helicopter), Fort Devens, was host to the student chapter members recently in a tour of Army Aviation facilities.

The highly popular feature in the term field trip program was arranged by the chapter's faculty advisor, Major James J. McKenna, SigC. Activities like this have helped build and maintain Norhteastern campus interest in AFCEA's 1957 "Chapter of the Year."

Philadelphia

A meeting of the Executive Board was held on November 10th at the Germantown Cricket Club to formulate plans for a series of interesting meetings for the coming year and to launch a concentrated drive for new members.

Meeting dates were set for December 11, January 15, March 5, April 23 and June 4, with the programs to be announced later.

Committee chairmen were appointed as follows: membership—Walter H. Eichelberger, Philco TechRep Div.; program—R. M. Fielding, Philco Corporation's Government and Industrial public relations director; publicity—Norma L. Testardi, advertising manager, International Resistance Company.

North Texas—William L. Doxey, Deputy Director, Electronic Components Research Dept., U. S. Army Signal Research and Development Laboratory, Fort Monmouth, who was the guest speaker at the chapter's October 24th joint meeting.

Rocky Mountain

At its first meeting of the 1958-59 season held on October 22nd, the chapter installed new officers for the coming year. These are headed by Col. Howard S. Gee, Headquarters Air Defense Command, as president, who succeeds Col. Oliver W. Miller, the 1957-58 president.

The other new officers are: vice president in charge of programs—Lew Wilson, Defense Electronic Products, RCA; vice president in charge of publicity and finance—Maj. F. L. Thomsen, Headquarters ARADCOM; vice president in charge of membership—G. Windschell, Rocky Mountain Tel. & Tel. Co.; secretary—Lt. Col. M. E. Wardell, Headquarters NORAD; treasurer—CWO D. L. Teague, Headquarters ADC; directors—Col. O. W. Miller, Headquarters NORAD; Col. T. H. McKenzie, Headquarters ARADCOM; Lt. Col. John Horvath, Headquarters ADC; L. L. Glezen, Headquarters NORAD; R. R. Marsch, American Tel. & Tel. Co.; G. Kinzler, Deits Bros. Hi-Fi & Photo Equipment Co., and Maj. B. D. Johnson, Headquarters ADC.

North Carolina—The Vanguard satellite was featured in the Southern Bell program presented at the chapter's October meeting. Left to right are: H. Y. Alexander, General Commercial Mgr., Southern Bell T&T Co., Charlotte; Maj. Jim Russell, Deputy Post Signal Officer, Ft. Bragg; Chapter President J. R. Fowler, Secretary and Treasurer, Carolina T&T Co., and J. F. Havens, Vice President of Carolina T&T Co.

Robert Olds, Creative Director of Alexander Film, Inc., Colorado Springs, addressed the members and their ladies following dinner at the Ent Air Force Base Officers' Open Mess. Mr. Olds first gave a brief sketch of the history of Alexander Film and then described the company's capabilities in the field of film advertising.

The chapter takes pride in an announcement made at this meeting that it has now assumed an international role. This is due to the recent affiliation with the chapter of some officers of the Royal Canadian Air Force on duty with Headquarters, North American Air Defense Command (DCS/CE). The names of these new members were presented as follows: Group Captain Robert Mooney, Squadron Leader Donald Bell and Flight Lieutenant David Reid.

Members and visiting guests introduced to the gathering included: R. K. Timothy, Manager, and R. F. Rouse, Plant Superintendent, Mountain States Telephone and Telegraph Co.; Byron Thady, past president of the chapter; Carlyle J. Pritchard of RCA, Dayton-Wright Chapter; Col. R. Kuehn, Headquarters NORAD; Col. A. Kowalski, Headquarters WADF; Lt. Col. E. J. Quashnock, Office of the Chief Signal Officer, and Maj. A. Biardino, Headquarters EADF, NORAD Region.

Rome-Utica

The Rome Daily Sentinel reported the chapter's November 19th meeting as follows:

"A two-star Air Force general last night warned against thinking Communists are 'just people as we are' who will compromise through 'reasonable' action.

"Maj. Gen. Edward H. Underhill, commander of the Eastern Defense Force, told a gathering of local scientists that Americans, to deal with Communists, must understand how they work and what they are really after—'they're after domination of the world.'

"He said Communist leaders were not sincere about Communism and referred to the novel written by Boris Pasternak, Russian winner of the Nobel Prize for literature this year, in which Pasternak 'makes clear' the Soviet government is 'not what the Russian Revolution meant to accomplish.'

"The general drew upon his experience as a member of the Korean Armistice Commission in the summer of 1953 to show that the only thing a Communist thinks 'proper, right, correct' is that which 'advances Communism.'

"His half-hour talk, followed by an extensive question period, was given before the Rome-Utica Chapter, AFCEA, at the Griffiss AFB Officers Club.

"Gen. Underhill, a pilot with some 30 years service, was one of ten members of the Military Armistice Commission. There were five from each side, and the Communist side was made

Rocky Mountain—Newly elected chapter officers are pictured above, from left to right: Gerry Windschell, Mountain States T&T Co., Vice Pres.; George Kinzler, Deitz Brothers Photo, Director; Lt. Col. John Horvath, USAFADC, Director; WO Donald Teague, USAFADC, Treasurer; Maj. F. L. Thomsen, USARADCOM, Vice Pres.; Lt. Col. M. E. Wardell, USAF, NORAD, Secretary; Col. Howard S. Gee, USAFADC, President; Maj. B. Johnson, USAFADC, Director; Louis Wilson, EDP (RCA), Vice Pres., and Richard Marsch, AT&T Co., Director. Not shown in photo are Col. T. H. McKenzie, USARADCOM, Director, and Col. O. W. Miller, USAF, NORAD, Past President and Director.

up of three North Koreans and two Chinese.

"The Commission was set up by the armistice agreement to supervise 'implementation' of the agreement and 'to settle, through negotiations any violations' of the agreement.

"Included as part of the Commission's responsibility was establishing and marking the demilitarized zone and the military demarkation line; supervising and directing the activities of the committee for repatriation of prisoners of war; handling of displaced persons and checking armistice violations.

"Gen. Underhill said the Communists made a play for the record and what would be good propaganda. He said their technique was to put us on the defensive during negotiations with false accusations which we therefore had to refute. They accused us, he said, of committing armistice violations they were doing or intended to do.

"He said they insisted upon complete inspection of our PW camps, but gave this 'runaround' to our inspection of their camps:

" 'We (our representatives) would travel by train, then by jeep, to the vicinity of the nearest prisoner camp, where we would usually arrive sometime in the afternoon.

" 'We would be told that the prisoner camp was a few miles further on but the road was so bad that it would take us several hours to get there and that the best thing to do was to stop and rest and bathe so that we would be fresh to make an early start the next morning.

" 'Unfortunately, we never got started the next morning. There was always a delay in collecting the transportation, assembling it and getting everybody aboard the vehicles. When we finally arrived at the prison camp it was usually deserted but we would be asked to make an inspection.

" 'Invariably, it would be clean, whitewashed and everything in very good order. Obviously, it had been done the night before.

" 'When we inquired as to where the prisoners were, we were always informed they had just left 30 minutes before we arrived. At only one or two camps did we ever see a prisoner. When we did it was only one prisoner.'

"He spoke last night because 'I'm afraid there are a lot of people who still think Communists are just people as we are. . . . This is a complete illusion, they are not people as we are, or as any we've ever dealt with before; they don't think, (or) act as we.'

"Gen. Underhill was introduced by Brig. Gen. Donald P. Graul, commander of Rome Air Development Center."

Scott-St. Louis

Robert M. Schwarz, Project Electronics Engineer, Missile Division, McDonnell Aircraft Corporation, St. Louis, discussed "Missile Guidance and Control System" at the November 7th dinner-meeting.

Mr. Schwarz stated that today's guided missiles are complex automatic-control devices and can properly be called servomechanisms—devices that perform operations in response to desired commands. The accuracy of performance of these operations can be improved by the incorporation of feedback loops. In the case of missiles, these feedback loops are the guidance and control systems.

The innermost loop consists of the power servos which drive the control surface to a desired position. Effects of airframe aerodynamic non-linearities require a second loop to sense missile motion. This sensing is accomplished by the use of rate gyros and accelerometers feeding back stabilizing signals to the autopilot. The third and outermost loop senses missile latitude, longitude, altitude and approach angle. Sensing elements for this loop are called guidance systems and include inertial navigation and radar systems. The feedback sensing signals from the guidance system are compared with desired signals stored in a programmer by a steering computer. This steering computer performs trigonometric computations in order to determine autopilot commands.

To illustrate his talk, Mr. Schwarz showed movies of flight testing the Air Force F-101 Voodoo and Navy F4H. Both aircraft were developed and are manufactured by McDonnell Aircraft Corporation.

Seattle

A program on "Single Side-band Transmission and Reception" was presented at the November 12th meeting by Lt. Col. Clark V. Telquist, Executive Officer of the Alaska Communication System.

Colonel Telquist opened his remarks by encouraging the industrialists who manufacture and sell electronic equipment to participate in AFCEA activities. He then gave a brief background of Single Side-band Transmission and pointed out that, through the cooperation of the Army with the telephone company, ACS was the first user of SSB in the Northwest.

Richard Young, Chief of the Radio Branch of ACS, explained, through charts and demonstration, the principles and advantages of SSB transmission and reception. In comparing the advantages of SSB with AM, he pointed out that: (1) the bandwidth of SSB is less than one-half that of AM, (2) the intelligibility ratio steadily increases in favor of SSB over AM as propagation conditions worsen, (3) for the same signal-to-noise ratio, only half the power is required for SSB (SSB suppressed carrier) as for AM. The process of developing a SSB signal was carefully explained and an interesting demonstration of SSB transmitters and receivers was presented, followed by a question and answer period.

The dinner-meeting took place in the Benjamin Franklin Hotel. Forty-nine members and guests were present.

South Carolina

The chapter met at the Wade Hampton Hotel on October 10th with seventy-three members and guests attending.

Following dinner, Chapter President William O. Kiger welcomed the group to the first meeting of the year and reported on plans for future activities.

After a short business discussion, the meeting was recessed to proceed to the Russell House at the University of South Carolina for the evening program

Rome-Utica—Shown at the chapter's November 19th meeting are, left to right: Col. Emmett M. Tally, Jr., Deputy Commander, Rome Air Materiel Area; Maj. Gen. Edward H. Underhill, Commander, Eastern Defense Force, who was the featured speaker; Chapter President William L. Roberts of Ramo-Wooldridge Corp., and Brig. Gen. Donald P. Graul, Commander, Rome Air Development Center.

CHAPTER NEWS

under joint sponsorship with the AIEE and IRE of the University and Columbia.

Dr. Cyril N. Hoyler, Manager, Technical Relations, RCA Laboratories, presented a lecture-demonstration on "New Adventures in Electronics," based on research at the David Sarnoff Research Center, Princeton, New Jersey. Dr. Hoyler outlined electronic developments to date and the new electronic developments of great promise for the future. The lecture culminated in the demonstration of the RCA Electronic Music Synthesizer. After the formal lecture, many of the members gathered around Dr. Hoyler for an informal discussion on the future of electronics.

South Texas

The chapter met at Randolph Air Force Base on November 24th.

Guest speaker was Maj. Hamilton B. Gardner who discussed the U. S. Army Signal Corps program of micro-miniaturization and modular construction.

Southern California

The Pentomic Army concepts to be used in meeting and mastering the challenge of the atomic battlefield were described at the chapter's October 8th meeting. Brig. Gen. Willis A. Perry, commanding the 47th AAA Brigade, which provides the anti-aircraft and guided missile defense for the Los Angeles area, introduced the program.

Following General Perry's introductory remarks, the U. S. Army film, "Pentomic Army" was shown. This 50-minute color film presented a lucid story of the need for dispersion, mobility, fire power, and ranging communications as a part of Army tactics in the Atomic Age, and, additionally, illustrated the Army's success in the integration of conventional with atomic and guided missile weapons.

The dinner-meeting was held in the Statler Hotel, with 173 members and guests present. Among these were military guests from the Ballistic Missiles Center, Bureau of Aeronautics General Representative's Office, and the U. S. Army Signal Corps, who were extended a special welcome by Chapter President John Inwood.

Southern Connecticut

The chapter opened its new year of activity with a dinner-meeting at the Wonderbar Restaurant, Bridgeport, on November 6th. Special guests were AFCEA Executive Vice President W. B. Goulett and Regional Vice President Glenn D. Montgomery.

Captain Goulett stressed the aims and purposes of the Association and the important role of the chapters in carrying out these objectives. Mr. Montgomery gave a report on the activities of other chapters in Region A.

The evening's program centered around the electron tube and was presented by officials of KIP Electronics Corporation, Stamford, who described the objectives and problems of a small company engaged in research and development and the manufacture of special purpose electron tubes for government and industry. KIP officials who conducted the program were: George W. Baker, president and founder of KIP, who was at one time Chairman of the War Production Board Design Committee for Miniature Electronic Tubes; John N. Higgins, Vice President (and newly installed chapter president); Robert Roylance and Arthur Darnsteadt.

Tinker-Oklahoma City

A tour of Western Electric Company's new plant in Oklahoma City, where the methods of manufacturing cross-bar central office equipment were demonstrated, featured the chapter's

(*Continued on page* 56)

Personnel Available

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ——, SIGNAL 1624 Eye St., N. W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

COMMUNICATIONS AND ADMINISTRATIVE RADM USN (Ret.) 31 years' service desires affiliation in communication, administrative or management position. Extensive experience in planning, operation and administration of communication facilities. Master of Engineering Administration, George Washington University. Box 144.

CONTRACT ADMINISTRATION, LIAISON OR RELATED POSITION. Graduate E. E. with Signal Corps electronic experience as officer and Navy civilian work as Contract Administer and General Engineer in electronics (Aircraft, Guided Missiles, Nuclear Power) desires position in private industry. Box 145.

Government and Military Positions Available

Government and military agencies are invited to use this column to announce available positions which may be of interest to the readers of SIGNAL. Notices will be published three times if not cancelled before. Applicants apply as indicated in individual notices.

OFFICE OF CIVIL & DEFENSE MOBILIZATION BATTLE CREEK, MICHIGAN

Persons who desire to apply for any of the listed vacancies should submit a Form 57 to: Director, Administrative Office, Office of Civil and Defense Mobilization, Region 4, Battle Creek, Michigan.

COMMUNICATIONS SPECIALIST (GS-301-7 or 9, $4980 to $5880 and $5985 to $6885 p/a) performs work involving the application of radio electronic standards, procedures, and technical knowledge in the development of Regional Communications Programs. Included is responsibility for emergency wire and radio communications as well as administrative communication of the Regional Office. Applicant should have operational knowledge of communications equipment and systems including wire and radio, and must be able to transmit and receive the international Morse Code at the rate of 20 wpm. Attendance at an accredited college or institute is desirable but not requirement of this position.

COMMUNICATIONS OFFICER (GS-1121-12, $8330 to $9530 p/a) is responsible for assisting Regional, State and local governments in establishing adequate communications systems and associated operations procedures and practices to assure communications essential to the continuity of Government in emergency; coordinating the use of communications systems of Federal, State and local governments for maximum utilization during any major disaster; and administering the communications and warning portions of the Federal Contributions Program. Applicant should have a total of six years of progressively responsible work in the field of communications of which three must be specialized in communications operations requiring a thorough knowledge of telephone, wire, cable or radio communication principles and practices. Education above the high school level may be acceptable in qualifying for the general experience requirements.

COMMUNICATIONS SPECIALIST (RADIO OPERATOR) (GS-1121-11 $7030 to $8230 p/a) performs technical duties in connection with establishing adequate Civil Defense Communications systems, processing matching funds requests for communication equipment, and coordinating the use of communications systems of Federal and other agencies for maximum utilization during major disaster. Included in the operation of telephone, teletypewriter, radio, security and associated facilities in the Regional headquarters and the emergency center. Applicant should have a total of six years of progressively responsible work in the field of communications of which three must be specialized in communications operations requiring a thorough knowledge of telephone, cable or radio communication principles and practices. Education above the high school level may be acceptable in qualifying for the general experience requirements.

ITEMS OF INTEREST

From Government, Industry and the Services

Color TV on Wheels

The Army Signal Corps is planning to use color television for on-the-spot coverage of "various training and operational activities."

This was disclosed in Washington recently when the Army's first completely-equipped color TV studio-on-wheels rolled into the city for a two-day demonstration for top military and television officials. The mobile color TV studio is a 35-foot-long, 18-ton aluminum trailer utilizing "partly transistorized" TV equipment. Some 8 tons of color TV equipment have been compactly fitted into the vehicle.

The studio-on-wheels was designed and developed for the Army Pictorial Center, Long Island City, New York, by the General Electric Company's Technical Products Department, Syracuse, New York.

According to William J. Morlock, General Manager of General Electric's Technical Products Department, the transistorized equipment has been developed over the past two years as part of the company's established trend towards simplicity and "miniaturization" of complex broadcast equipment.

As an example, the new transistorized color TV cameras weigh but 215 pounds each, 75 pounds less than non-transistorized models. Dimensions are 34 by 18 inches. Over-all size is 10 inches shorter, three inches narrower and about an inch lower than non-transistorized models.

Lt. Col. Hollis Dakin, Chief of the Television Division at the Long Island Pictorial Center, where the trailer was subsequently delivered, said it will be used primarily for determining the increased value of color TV in military applications. The mobile studio is expected to be used "anywhere in the country" for covering various military assignments.

Col. Dakin said the new trailer will "solve a need we've had for a long time." The Signal Corps has a number of projects lined up for the device he said but did not elaborate.

General Electric broadcast engineers speculate the trailer could be used for covering maneuvers, missile launchings, atomic problems and medical training programs. Col. Dakin emphasized, however, that in no way was the trailer designed for combat purposes. Rather, he explained, it would be used initially "to determine the degree of importance of color TV in military applications."

MARS Speakers

February speakers for the First Army Military Affiliate Radio System (MARS) Technical Net (SIGNAL, Sept., p. 50) will include:

February 4: "Observation of Radio Signals Transmitted from Earth Satellites" by Lloyd H. Manamon, Chief of the Communications Facilities Section, Long Range Radio Branch, U. S. Army Signal Research and Development Laboratory, Fort Monmouth.

February 11: "Vehicular Noise Problems in Mobile Communications Systems" by Stuart F. Meyer, Mobile Engineering Manager, Allen B. DuMont Laboratories.

February 18: "Experience with Video Tape Recording" by Lawrence Weiland, Staff Engineer, National Broadcasting Company.

February 25: "Mobile SSB Communications" by Werner Brach, Chief Engineer, Eldico Electronics.

The talks will be held on Wednesday at 9 PM EST on 4030 kc. upper sideband.

Advisory Committee

On behalf of the President, Leo A. Hoegh, Director of the Office of Civil and Defense Mobilization, has announced the establishment of a Special Advisory Committee on Telecommunications.

The committee was created to review the role of the Federal Government in the management of U. S. telecommunications, including the allocation of the radio spectrum.

Mr. Hoegh said the committee's main task is to recommend methods to bring about improvements in the use of telecommunications resources. It will examine the existing governmental policies, use of facilities and administrative arrangements and procedures for the allocation, management and control of telecommunications including the radio frequency spectrum for government and non-government use. The group will not be concerned with existing regulatory powers or procedures of the Federal Communications Commission nor will it make studies of detailed problems such as radio frequency usage.

The Advisory Committee has been asked to make its recommendations to Mr. Hoegh for submission to the President by the end of 1958.

In announcing the establishment of the committee, Mr. Hoegh said that rapidly changing technology and changing needs in both government and non-government areas are presenting increasingly difficult problems in telecommunications management. The situation, he said, is becoming no less complicated by developments in satellites and space vehicles as well as defense weapons systems and civil defense communications.

The five-man committee is chairmaned by Victor E. Cooley and includes Irvin Stewart, Frank Gregg Kear, William Glasgow Thompson and W. Preston Corderman.

Magnetic Field Measured

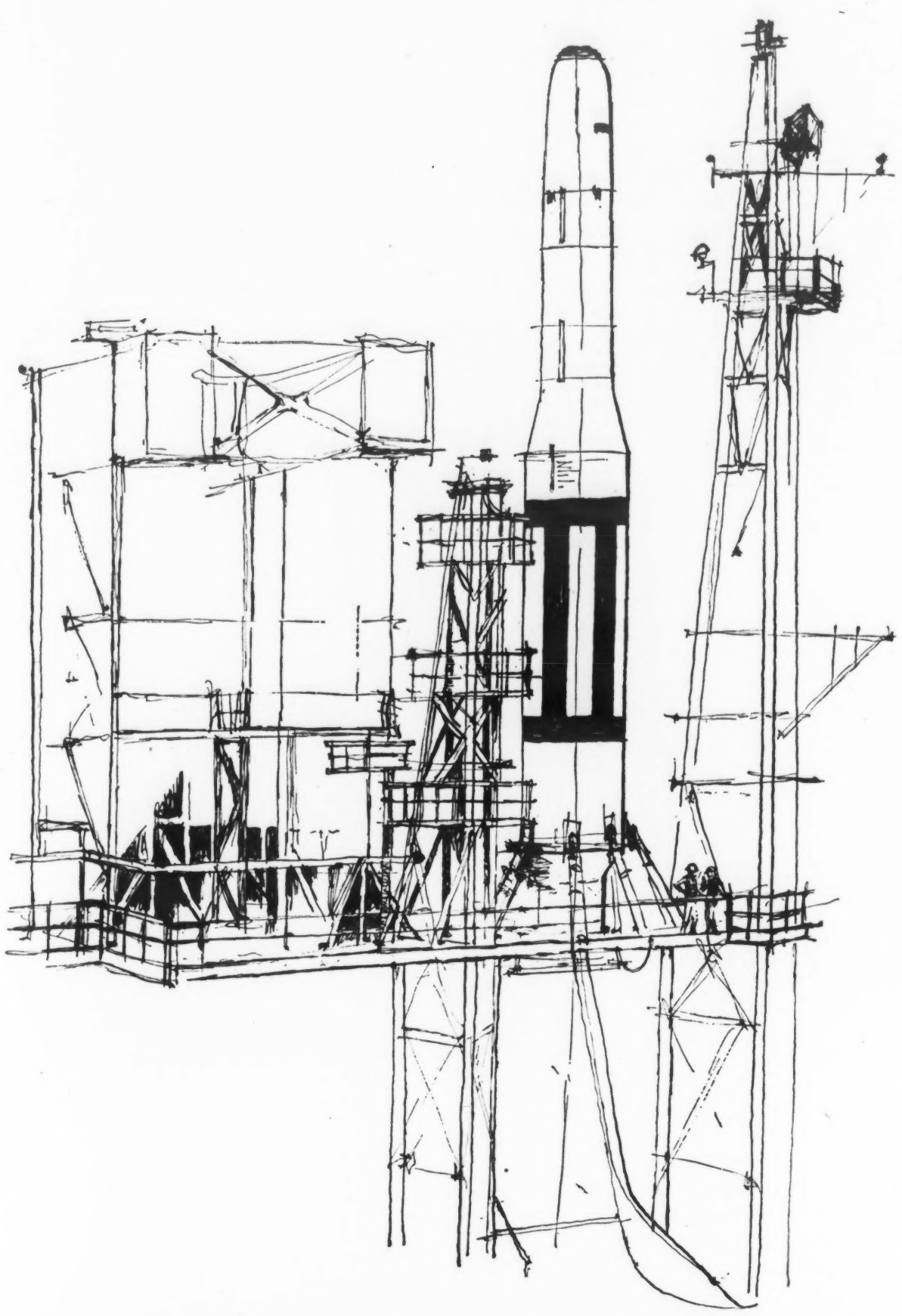
By the development of an idea first demonstrated approximately five years ago, a Coast and Geodetic Survey scientist has succeeded in harnessing the proton of a hydrogen atom to measure the horizontal and vertical components of the earth's magnetic field.

The announcement was made after a report was received that the instrument, called a "Proton Vector Magnetometer," had been successfully tested at the Survey's Fredericksburg, Va., Magnetic Observatory.

An earlier instrument, the "proton-precession magnetometer" was only capable of measuring the over-all force, but not the direction of the magnetic field. The new magnetometer, developed by James H. Nelson, can measure with absolute precision the magnetic force in both a horizontal and vertical direction, as well as the over-all intensity. Through the use of polarizing coils around a plastic cup containing about a pint of distilled water, the instrument introduces a magnetic field which causes the spinning protons to whirl at right angles with the earth's magnetic field, instead of in line with it, as they normally do. When the induced magnetic field is eliminated, the protons gradually return to their normal path and in doing so create

(*Continued on page* 51)

There is nothing else like this under the sun. It is the Martin-Denver facility birthplace of the Air Force TITAN. It is also this country's most advanced and fully integrated big-missile development center. Here, our most formidable weapon systems of tomorrow are being designed, built and tested—from the smallest component to the total system—within a single 7,000 acre complex. Every top military and scientific expert who has seen Martin-Denver from *within*, considers it one of our most valuable national resources.



a small alternating current. The frequency of this current, which can be precisely measured, is directly related to the strength of the magnetic field.

The magnetic field affects the horizontal direction of a compass needle and the needle is also affected in a vertical direction. A freely suspended compass needle which tips towards the ground at a 70 degree angle, (near the magnetic pole) would point straight up and down. By sending an electric current through two large coils (40 inches in diameter), surrounding the water-filled container, the new magnetometer can measure either component of the magnetic field by neutralizing the magnetic effect not desired. All this can be done in 30 seconds as compared to one and a half to two hours needed for conventional instruments.

"Push-Button" Navigation

A "push-button" navigation system has been developed which guides helicopter pilots "unerringly" to a series of targets and then "remembers" the way home—even when home is a fast moving ship.

The U. S. Navy and Sperry Gyroscope Company recently made the announcement.

According to reports, by means of a lightweight airborne computer and a single pictorial cockpit indicator, the pilot will be able to skip randomly —but accurately—to a series of unmarked locations. The electronic "mastermind" also will direct him on a straight-line return to his mobile base.

A self-correcting system with "judgment," the equipment rejects all but the most accurate navigation information. It automatically selects the most reliable data, either radar or radio signals or the latest correct air mass information.

Filling the complex navigational requirements of diverse Navy helicopter operations, the system provides the great precision required for difficult anti-submarine screening and killer missions, Sperry's aeronautical equipment division said.

The pilot maneuvers his craft to follow a "V" bar on the indicator which points out target direction. A counter similar to an automobile mileage indicator continuously shows the exact distance to target.

The pilot can set in new alternate destinations at will. Versatility of the system enables him to eliminate a destination, change the order of destinations and, in event of an emergency, cancel his pre-set flight plan and return to base.

Names in the News

John R. Howland has been appointed Sales Manager-Closed Circuit Television and Product Control Equipment for Philco Corporation's Government and Industrial Division. For the past three years, Mr. Howland was General Sales Manager of the Dage Television Division, Thompson Products, Inc.

Frank E. Greene has been named Manager of Marketing, Airborne Systems Department, RCA Defense Electronic Products. Formerly Manager, Defense Marketing Negotiations, RCA Defense Electronic Products, Mr. Greene succeeds **Ralph S. La Montagne**, who becomes Marketing Manager of the newly-created Missile Electronics and Controls Department.

John G. Copelin has been elected a Vice President and Comptroller of International Telephone and Telegraph Corp. Mr. Copelin, who has been Vice President and Comptroller of ITT's subsidiary, International Standard Electronic Corp., will continue to hold these positions.

F. N. Sutherland, C.B.E., M.A., M.I.E.E., for eleven years General Manager of Marconi's Wireless Telegraph Company Limited, has been elected to the Board of Directors of the company and appointed Managing Director. He also has been elected a Director of Marconi Instruments Limited.

Thomas J. Hargrove, Chairman of the Kodak board, is a member of the new executive committee created recently by the Directors of the Eastman Kodak Company.

Robert W. Hughes, John E. Kahelin and **Charles G. Sherwood** have been elected Vice Presidents of International Electric Corporation, newly-formed unit of ITT. It was organized to manage the production of a worldwide electronic control system for the Strategic Air Command.

Colonel Jules E. Gonseth, Jr., has assumed the post of chief of the Aviation Department at the United States Army Electronic Proving Ground. His former assignment was that of Commanding Officer of Camp Gary, San Marcos, Texas.

William W. Bumpus, Regional Systems Engineer and former Manager of Consolidated Electrodynamics Corporation's district sales office in Washington, D. C., was appointed manager of a new government liaison office.

R. T. Nelson has been promoted to the rank of Major General. General Nelson is currently Deputy Chief Signal Officer, Department of the Army.

NEW PRODUCTS FROM INDUSTRY

30-Second Enlargement Of Microfilm

Haloid Xerox Inc., of Rochester, New York, has announced the development of a device that automatically enlarges a 35mm microfilm frame to a positive, dry, 18" x 24" copy of an original engineering drawing in 30 seconds. The machine is called a Xerox® Copyflo® 1824 printer. It is believed to be an important adjunct to unitized microfilm systems, the modern approach to high-quality low-cost reproduction of engineering drawings.

Operating on the electrostatic principles of xerography, a clean, fast drying process, the device provides a rapid, inexpensive method of "blowing back" or enlarging microfilmed drawings to workable size. Enlargements may be made on plain white paper, vellum or offset paper masters. The microfilm frames are mounted in die-cut apertures of punched data-processing cards. Featuring a push-button operation, an operator inserts a data-processing card, then presses a button to set the automatic process in motion.

The Copyflo printer, available in the fall of 1959, was introduced by Joseph C. Wilson, Haloid Xerox President at Copyrama, an exhibit for industrial executives, government representatives and the press, showing the company's new products, held at the Mayflower Hotel, Washington, D. C.

New Terminal Block Available to Industry

Designed for use with ground support equipment such as missile launchers, trailers and test stand equipment, the T-1000 Terminal Block, developed by Twin Lock Incorporated, Inglewood, California, is now available to the aircraft and missile industries.

The block, which measures 5" long by $1\frac{1}{16}$" wide, by $\frac{3}{4}$" high, is constructed of a molded phenolic base with reinforced barriers between terminal cavities, one cavity accommodating four terminals. Up to 40 connections can be made with one block, and adjacent terminals can be bussed together with special connectors.

The terminal lugs, available in bulk or in strip bands of 1 to 3000 for automatic assembly equipment, and the block sockets are gold plated to meet environmental conditions of salt spray and humidity. Because of simple installation procedures of installing the lug and tightening the set screw, harness fabrication and assembly time can be cut by 50% according to Twin Lock. After a lug is secured in the block, over 100 lbs. pressure is required to break the connection.

Exposure Meter for High-Speed Photography

Designed specifically for high-speed photography, a new exposure meter has been introduced by the Industrial Products Division of Fairchild Camera and Instrument Corporation of Long Island, New York.

The exposure meter (HS3201), described as the first and only reflectance type meter, measures only the amount of light that reaches the film. Light readings may be taken from the camera position by sighting on the subject, and the narrow acceptance angle of 2 degrees gives accurate pinpoint readings.

Operation of either the high or low range buttons on the underside of the meter gives a dial reading for the field. Correct aperture setting can be read directly from the ring scale, preset to the film speed.

Improved Tube Increases Useable Screen Area

Development of a new cathode ray tube that increases the distortion-free useable screen area by 20%, due to a flat faceplate as opposed to a beveled faceplate, has recently been announced by Allen B. DuMont Laboratories of Clifton, New Jersey. Developed as a direct replacement for the Type 3XP (beveled faceplate) cathode-ray tube, the improved version also features a uniform glass surface which reduces errors from parallex, a glass rodded gun construction which offers greater physical rigidity, better alignment of parts, and tighter tolerances, all assuring improved electrical stability.

This type of cathode ray tube is used in miniature oscilloscopes, equipments for monitoring and metering and stack piles for multichannel oscilloscope photography where continuously moving film acts as the horizontal sweep. The 3" by $1\frac{1}{2}$" rectangular screen tube is $8\frac{3}{4}$" long and has electrostatic deflection and focus. It is available with P1, P2, P5, P7, and P11 phosphors.

'One-Shot' Switch

The unique capabilities of a new series of push-button switch assemblies are believed to eliminate the need for designing special pulse input circuits for high-speed electronic switching devices. The series (1PB-600) incorporates an electronic circuit to produce a single, microsecond-length pulse with each operation.

Developed by Micro Switch, Freeport, Illinois, a Division of Minneapolis-Honeywell Regulator Company, the 'one-shot' switches are designed for use in electronic test circuits, keyboard input consoles, fusing arming and firing circuits and reflected pulse systems.

The square wave pulse width is factory adjustable from .2 to 2.5 microseconds, and the amplitude from 3 to 60 volts. Both width and amplitude are independent of the speed of switch operation. The switches operate in a temperature range of minus 65 to plus 185 degrees Fahrenheit. The electronic circuit used in the new switches includes a capacitor, resistor, magnetic core and diode.

Carrier-Radio Communications

The 911 VHF Communications System, a thin-route carrier-on-radio package providing four to eight voice channels for quick and economical installation is the newest addition to Lenkurt Electric Company's line of telecommunications systems.

The carrier-radio package is described by the company as offering extreme flexibility in its combination of narrow-band FM radio equipment with certain standard Lenkurt carrier equipment. In addition to voice channels, it can provide order wire, control and supervision circuits. The radio equipment may be operated anywhere from 148 to 174 mc at the 50 watt power output. The 119-db system gain offers maximum span length with low signal-to-noise ratio.

Economical features of the system together with its light weight and easy installation make it adaptable to permanent application to light traffic toll routes and to temporary use for seasonal or emergency requirements. Shipped as a factory-wired and tested package ready for installation, it also can be used easily to provide circuits to summer resorts, construction sites and military installations and for emergency restoration of service.

High-Speed Minicard System

An ultra high-speed information handling system, called the Kodak Minicard system and developed by Eastman Kodak Company of Rochester. New York, is said to combine the advantages of microfilm, punched cards and digital computing techniques. The Minicard system records documents, pictures or other information photographically on tiny pieces of film about the size of a postage stamp. By the use of complex electronic controls, the system can be utilized to retrieve any desired information by searching the Minicard film records automatically at speeds up to 1,000 a minute. The documents or other information together with their identifying code symbols are contained on each Minicard film record, each of which may include up to 12-legal size documents at a reduction ratio of 60 to 1. When the desired Minicard film record has been obtained from the system, its contents may be examined at full size on a reader and duplicates or full size paper prints may be made automatically.

The system is expected to be useful in handling, storing and retrieving vast quantites of information relating to scientific fields. Specialized applications for business, industry and educational use may be developed.

The first complete system is now in use by the U. S. Air Force in the Pentagon and due to further commitments to the government, the system will not be generally available until they are fulfilled.

Supervoltage Machine For Medicine

A 6-million volt linear accelerator for medical therapy and research applications, that produces a sharply defined beam of intense x-rays and can also be converted to a high energy electron output, has been developed recently by the High Voltage Engineering Corporation of Burlington, Mass.

As a radiological tool for large-scale clinical programs, the Linac has an x-ray output of 200 roentgens per minute at 100 centimeters which permits target-to-skin distances that protect against skin damage, and a high depth dose with relatively short treatment times. The Linac produces an electron beam less than 5 mm. in diameter on the x-ray target. Extremely sharp field definition is thus obtained and the penumbra produced by large x-ray and gamma ray sources is avoided.

Converted to electron output, the Linac delivers up to 500 watts at energies from 2 to 7.5 Mev. According to the company, its convertibility and accurately controlled electron output make it an invaluable tool for sterilization of tissue and bone transplants, surgical materials, and for biophysics, biological and cancer research.

New Literature

New Industrial Magazine

For the engineer, for management, for the scientist and for the military who are concerned with environmental and reliability problems, *Environment*, a new monthly industrial and engineering magazine will be published in 1959 by Ray Mattingley of the Mattingley Publishing Company, P. O. Box 286, Oakhurst, N. J. The publication will serve as a forum for the swift exchange of specialized information and ideas and will encompass the fields of environmental test equipment, engineering, testing, science and research, according to the publisher.

Men Behind Missiles

For meeting the challenge of the Cold War and the Space Age, much of the credit must go to the missilemen behind the scenes at Cape Canaveral, at White Sands Missile Range, and at the U. S. Army School, the Air Defense Ordnance Guided Missile School and numerous other training schools. In a well-illustrated 20-page pamphlet prepared by the Missile and Space Vehicle Department of General Electric, *The Professional Army Missile Expert — A Soldier First*, the roles of the men and soldiers, responsible for the training, research, educating, liaison work, testing and evaluating and operation maintenance in missile work are described.

Copies are free and may be obtained by writing to the Missile and Space Vehicle Department of General Electric Company's Defense Electronics Division, 3198 Chestnut Street, Philadelphia 4, Pa.

Federal Agencies' Scientific Information

A series of reports, dealing with the policies and procedures of each Federal agency and relating to various aspects of scientific information, an inventory listing of all significant scientific information sources or activities within the Federal Government, is now available from the National Science Foundation.

A primary objective of this series undertaken by the Foundation's Science Information Service under its Unpublished Research Information Program, is to make unclassified, unpublished scientific research information easily accessible to all U.S. scientists and engineers. Each bulletin will report on a specific branch of government.

Copies of the bulletins and further information are available from the National Science Foundation, Science Information Service, Wash. 25, D. C.

Methods and Management Of "Automatic Office"

Material relating to management in the field of office automation is now being offered by Gille Associates, Inc. in their new bi-monthly publication, *Machine Accounting And Data Processing*.

According to Frank H. Gille, publisher, "news material on equipment, services, supplies, texts, conferences and the like will give the reader current information sources that can serve him further in effecting the most productive data processing operations."

Each issue of the magazine will contain a special feature around which a particular theme will be developed. The theme feature of the Charter issue (November-December) is "The Role of Punched Cards in the Automatic Office." Future issues will emphasize "A Closer Look at Computer Feasibility," and "The Role of Punched Paper Tape in the Automatic Office."

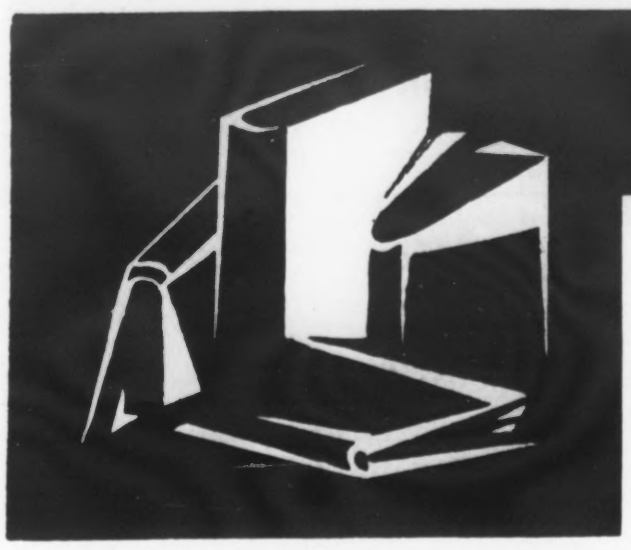
Published by Gille Associates, Inc. in Detroit, subscription rates are $7.50 a year, $1.25 per issue.

Antenna Systems Catalog

Particularly for antenna system planners and engineers, Andrew Catalog No. 22, a 96-page product and facility book covering antennas, antenna systems and transmission line products, should be a useful reference.

New product developments in 21-inch waveguide, high power transmission lines, ground-to-air and telemetry antennas, microwave and two-way communication antennas, and the introduction of two new sizes of Heliax (flexible coaxial line) are included. In addition to engineering data, the catalog has a 16-page section of general antenna systems engineering information and a price list at the end.

The catalog is available on request by writing to Andrew Corporation, 365 East 75th St., Chicago 19, Ill.



Books

BRAVE NEW WORLD REVISITED, by Aldous Huxley. Harper & Brothers, New York. 147 pages, $3.00.

In the Nuclear Age of the Twentieth Century, Aldous Huxley takes another look at his brave new world of the Sixth Century A. F. (after Ford), and discovers with trepidation that it is too close to becoming a reality. Basing his fears on a Malthusian approach, Huxley discusses the chain reaction set off by overpopulation, which leads to economic insecurity, social unrest and thus to increased power by the central government. From there it is not too long a step to the exploitation of human suggestibility by the "power elite," the "hidden persuaders," brainwashing and thought control, which has gone far beyond even the dreams of Hitler and Stalin.

Assuming that the great powers will restrain themselves from atomic warfare long enough for his predictions to come true, Huxley fears that the rational process of the free, thinking individual human being is being conquered by the scientific dictatorships of advertising, drugs and mass communications—inhuman dictatorships that too soon may become tools in the hands of an all too human dictator.

Citing the opinions of men such as Malthus, William Whyte, C. Wright Mills, Vance Packard, James Bonner and others, Huxley offers a challenge to complacency and a plea to mankind that it educate itself before it is too late.

DEATH OF A NATION, The Story of Lee and His Men at Gettysburg, by Clifford Dowdey. Alfred A. Knopf, New York. 351 pages, $5.00.

Why did the South lose the Battle of Gettysburg? There has been an overabundance of literature about the Civil War, and the Battle of Gettysburg, but few have dealt so thoroughly and in such a controversial and interesting manner with all phases of July 1, 2, and 3, the days of the battle itself, as Clifford Dowdey does in *Death of a Nation.*

From a bird's-eye position among the Confederate ranks, Dowdey narrates in extensive detail and with power the record of human tragedy, the military strategy and progress of the battle. He probes searchingly into the personalities involved and examines in a new and highly controversial light, the reasons for the ultimate defeat of the Confederate army. Did Jefferson Davis deprive Lee of badly needed troops and fail to trust his judgement? Were Lee's subordinates ineffective and did they fail him at crucial moments?

THE DIVINE WIND: Japan's Kamikaze Force in World War II, by Captain Rikihei Inoguchi and Commander Tadashi Makajima, with Roger Pineau, Commander, USNR. U. S. Naval Institute, Annapolis, Md. 240 pages, $4.50.

The frantic efforts of the Japanese Navy in the closing days of World War II which resulted in the creation of the Naval Special Attack Force (*kamikaze*) will go down in history as an outstanding and yet mysterious event. *The Divine Wind* presents a full and interesting account of the conception, organization, tactics and training of Japan's suicide pilots, told primarily by two Japanese Naval officers with the Special Attack Force.

The how and the what of the *kamikaze* is now well-documented, but why did more than 4,000 pilots hurl themselves and their planes into oblivion against the U. S. Pacific Fleet? Perhaps the most mystifying and fascinating aspect of this suicide squad is its illustration of a philosophy so alien to Western civilization. To most American soldiers there must always be the hope of even a slim chance of survival no matter how futile the effort seems. While to the Japanese *kamikaze* pilots, every avenue of escape was closed with the knowledge of certain death.

The origin of the term, *kamikaze* (divine wind), lies in a heaven-sent typhoon that protected the Japanese islands from a Mongolian invasion in 1281. The chapter on the last letters home of the deathbound pilots, is the most stirring and perhaps the straightest path into the minds of these men who could leave so much to fate, and whose beliefs were so tied up in their religion, their love of family and their unequivocal willingness to die for Japan.

ELECTRONIC ENGINEER'S REFERENCE BOOK, General Editor, L. E. C. Hughes. The MacMillan Company, New York. 1294 pages, $18.00.

The application of electronics is no longer as limited a field as it has been in the past, but is rapidly expanding its range to more and more phases of older and traditional branches of engineering. As a result, a basic electronic knowledge and an awareness of its possibilities is becoming essential to all engineers.

Electronic Engineer's Reference Book attempts to put before engineers in industry and in development laboratories some of the latest knowledge which might not be easily available to them. It views the problems and possibilities of various subjects examined from various points of view—physical, chemical, production, safety, reliability, and maintenance. Information included ranges from the origin of the various effects indicated under the general definition of the term 'electronics' to the practical realization of devices based on them and the utilization and integration of these in industrial plants.

The main body of the text is divided into nine main parts—fundamentals, radiations, electrics, valves, materials, vibrations, computers, automatics and miscellaneous. Each of these is subdivided, numbered and subdivided again into as many as nine sections each with up to nine articles.

ANTARCTIC ASSAULT by Commander Paul W. Frazier, USN. Dodd, Mead & Co., New York. 237 pages, $4.00.

A human approach to the pioneering exploits in the Antarctic is depicted by Cmdr. Frazier, a vital member of Dufek's volunteers. Participating in the struggle to build and supply stations on the remote wastes of the Antarctic, now used as the observation bases of the International Geophysical Year, Cmdr. Frazier relates this personal saga with humor, accuracy and drama.

Beginning with Operation Windmill in 1947, which made the first assault against the ice and snow to establish ground control points, the race against time and the elements continues through Operation Deep Freeze I and II to the planning of Operation Deep Freeze III in 1957. The hostile terrain of the Antarctic, treacherous hidden crevasses, crumbling ice shelfs and frustrating hours of ice breaking that seemed to get nowhere, all claimed lives and made day-to-day existence dramatic and suspenseful.

AFCEA Insignia

Available for immediate purchase: Lapel button for civilian dress, bronze—$1.50, sterling—$2.50 and gold—$5.00. AFCEA official medal, bronze—$3.00, silver—$4.00 and gold—$5.00. 3" dia. decalcomania, 4 for $1.00. Membership certificate, $1.50.

All insignia may be ordered from: AFCEA Service Dept., 1624 Eye St., N.W., Washington 6, D. C.

CHAPTER NEWS

(*Continued from page 48*)

November 20th meeting.

Company personnel who conducted the tour were: D. B. Powell, Chief of Industrial Relations, and R. C. Arens, Engineer, Apparatus and Piece Parts. They each conducted a group through the plant where main frames for crossbar relay telephone systems are built, and discussed the operation of this pilot plant and its relation to the permanent facility to be constructed during the next two years. The purpose of the pilot plant is to train the key employees for the permanent plant.

The tour started along the assembly line and covered each phase of the operation from coil winding to relay assembly, from terminal strip manufacture and cable harness wiring to installation in the frame, and from frame manufacture to the completed assembly ready for shipment. At present, installed in one large room, the various departments are served by a very efficient flow system based on an overhead monorail conveyor which handles the heavy frames. Upon completion of the permanent plant in 1960, the Oklahoma City plant will supply the rapidly expanding Southwestern Bell Telephone System, as well as some other Bell System requirements.

Washington

A change of pace brought football into the spotlight at the chapter's November luncheon meeting. Featured speaker was George Preston Marshall, President of the Washington Redskins.

Guests at the head table were: Col. William J. Moran, Deputy Chief of Chaplains, Department of the Army; Morrie Siegel, news commentator, Radio Station WMAL and TV Station WTOP; Burt Hawkins, sports writer for *The Washington Evening Star;* Col. James B. Henson, Deputy Chief Community Relations, USAF; Jim Gibbons, news commentator, Radio Station WOL and TV Station WRC; Rear Adm. Jack Dorsey, Deputy Director for Communications-Electronics, Joint Staff, JCS; George Makris, Director of Athletics, Bolling Air Force Base; Jim Castiglia, President of the Touchdown Club; Rear Adm. William Dolan, Asst. Chief of Bureau for Technical Logistics, Department of the Navy; James M. Bridges, Director of Electronics, Office of the Assistant Secretary of Defense (Research and Engineering); Bob Addie, sports editor for *The Washington Post and Times Herald;* and Redskin players Ralph Gugliemi, Gene Brito, Chuck Drazenovich, and Johnny Carson.

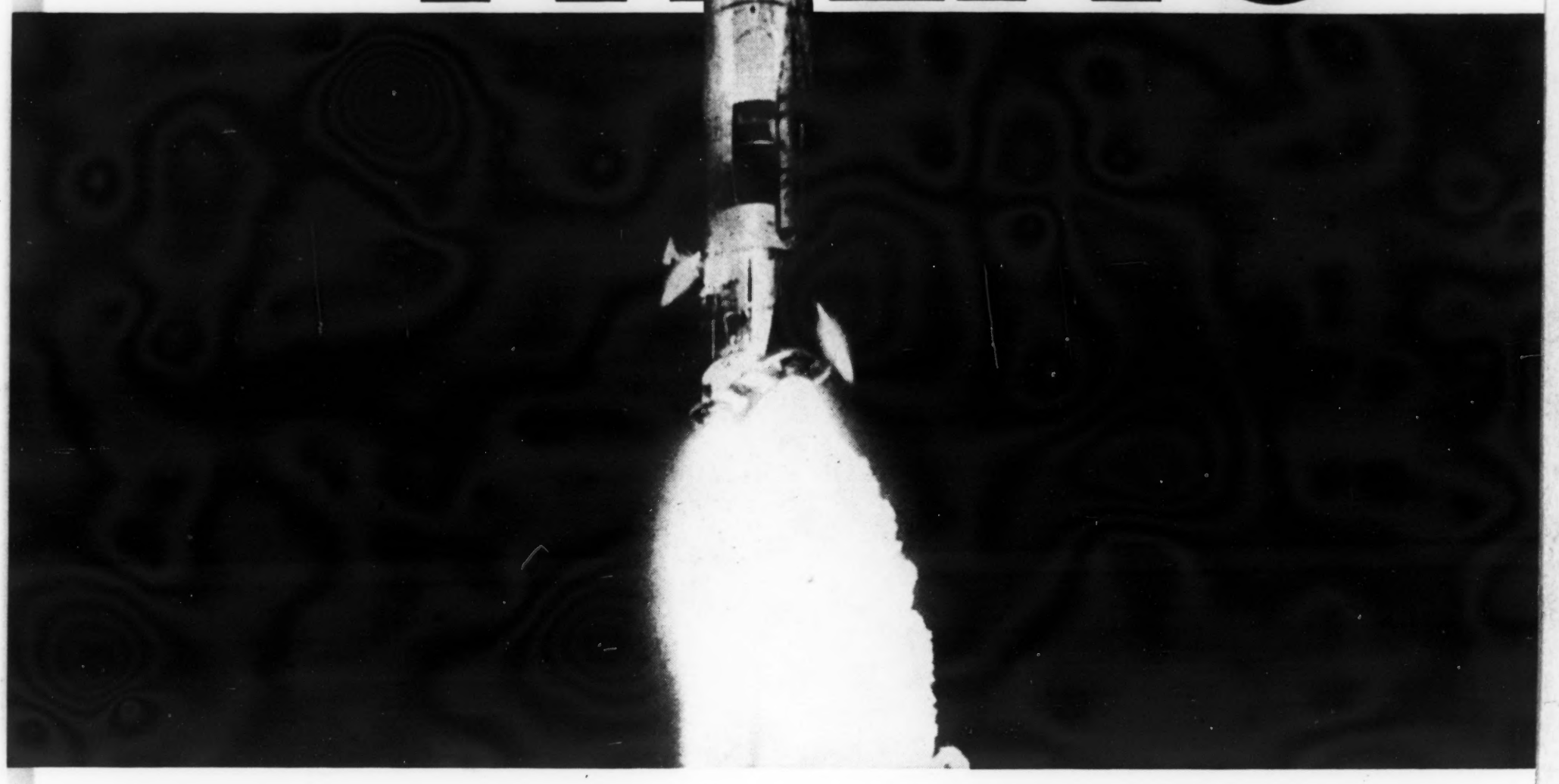
Chapter president John R. O'Brien officiated as master of ceremonies.

INDEX TO ADVERTISERS

Preserver of Peace . . .

ATLAS

Air Force "Sunday Punch"



Boosted into space by the fiery thrust of three huge rocket engines, the seven-story Atlas intercontinental ballistic missile roars upward from its Cape Canaveral launching pad. Quickly it sheds the frost encrusting the liquid oxygen tank and races to its predetermined destination in the far reaches of the globe. In its size and range and capability, the Air Force Atlas is a commentary, for all the world to heed, of the necessity to maintain the peace. RCA's Missile and Surface Radar Department has been privileged to design and develop ground check-out, launch control and cabling equipment as a major subcontractor to Convair (Astronautics) Division of General Dynamics Corporation, the Atlas prime weapons systems contractor.

RADIO CORPORATION of AMERICA

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DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N. J.

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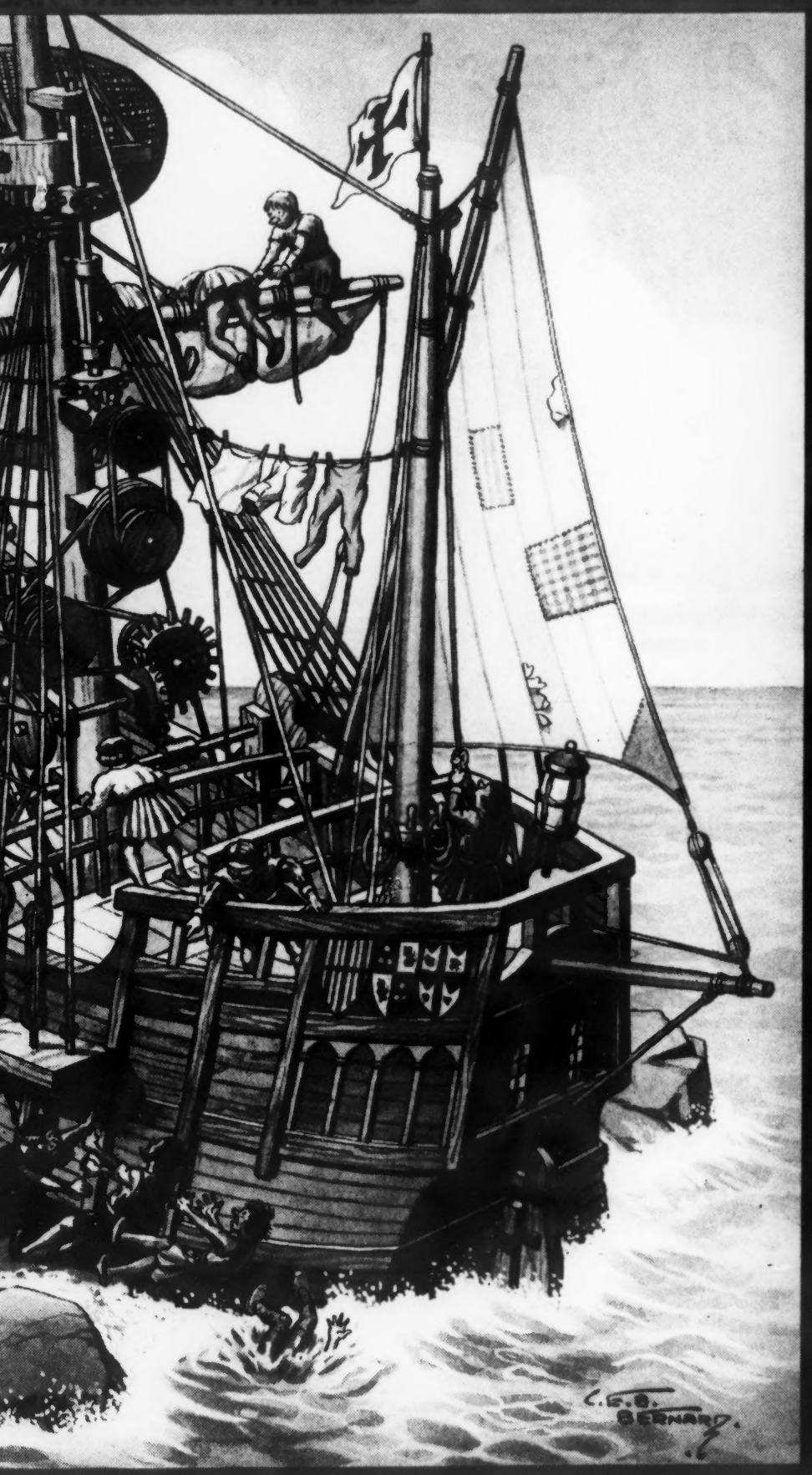
that gave rise, among other things, to a peculiar kind of mariner's nausea that came to be known as "throwing down".

So it is hardly surprising that on the morning of October 12, 1492, Columbus found himself on the rocks at San Salvador. Once on land, the crew re-christened the thing with no name and called it "radar" — the thing that looks the same way coming or going.

A few days later, the radar operator discovered the trouble: the tubes had been inserted upside down. Columbus was so grateful he bestowed upon him the Order of Camob . . . which, of course is Bomac spelled backwards.



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